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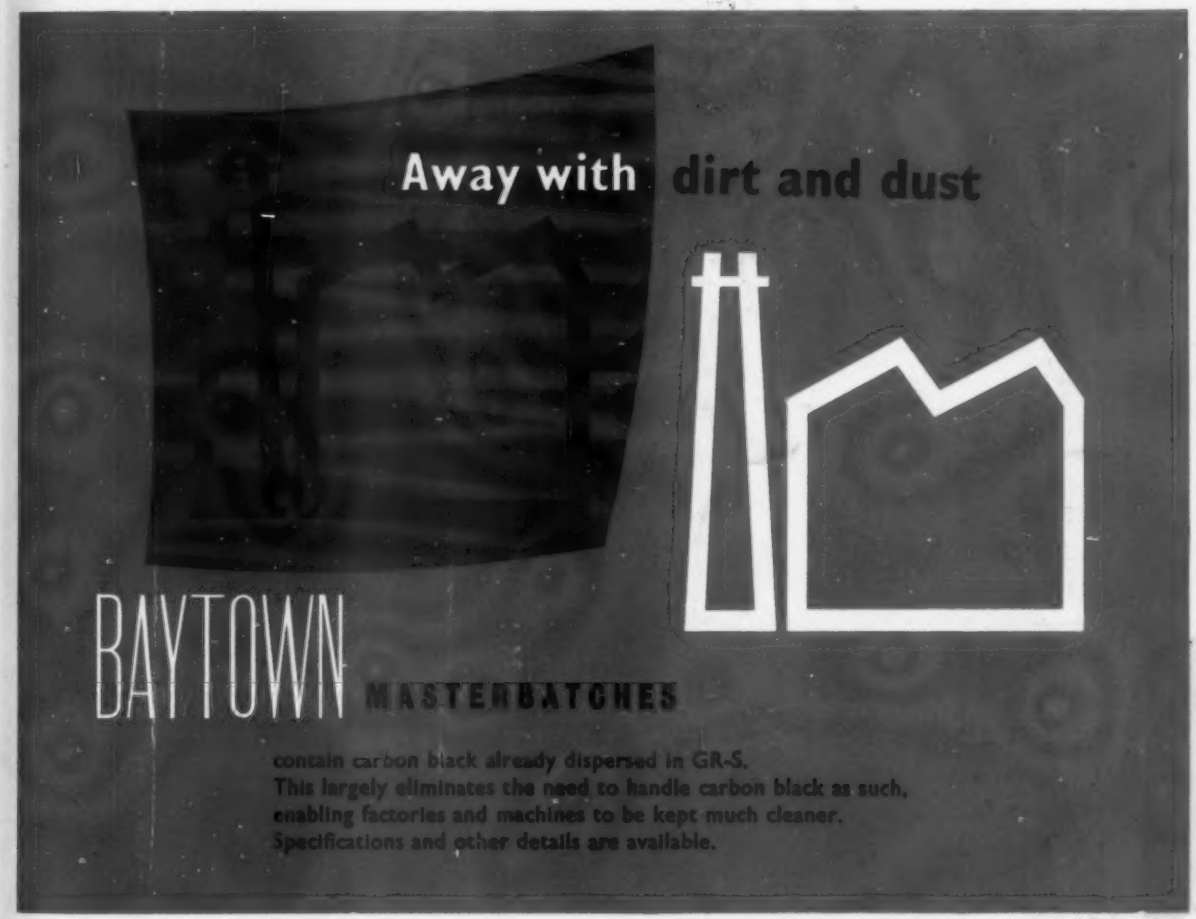
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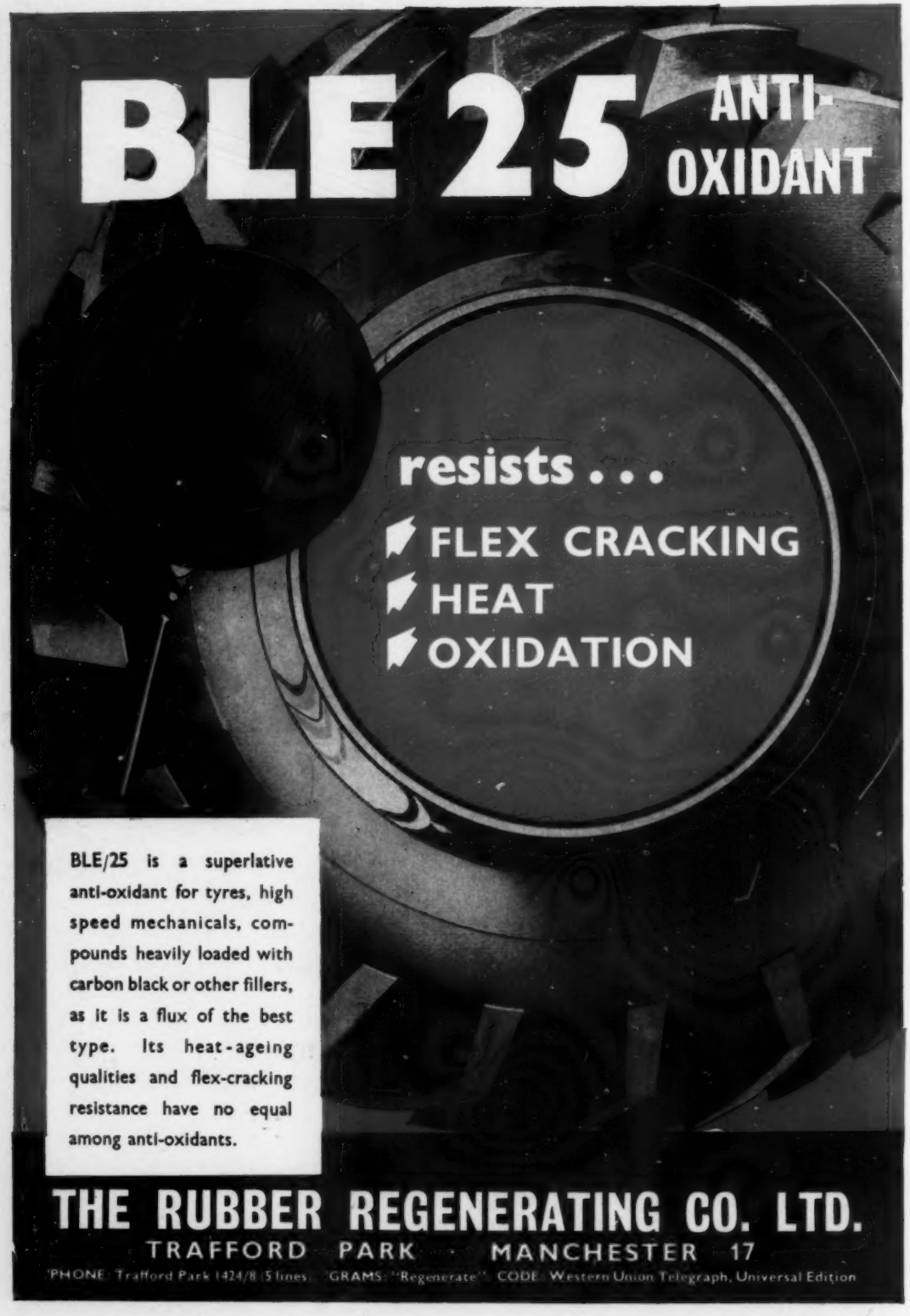

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IN ITS 76th YEAR

December 26 1959

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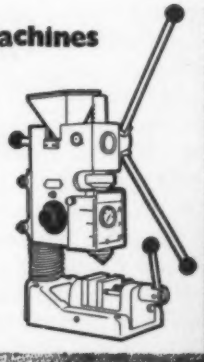

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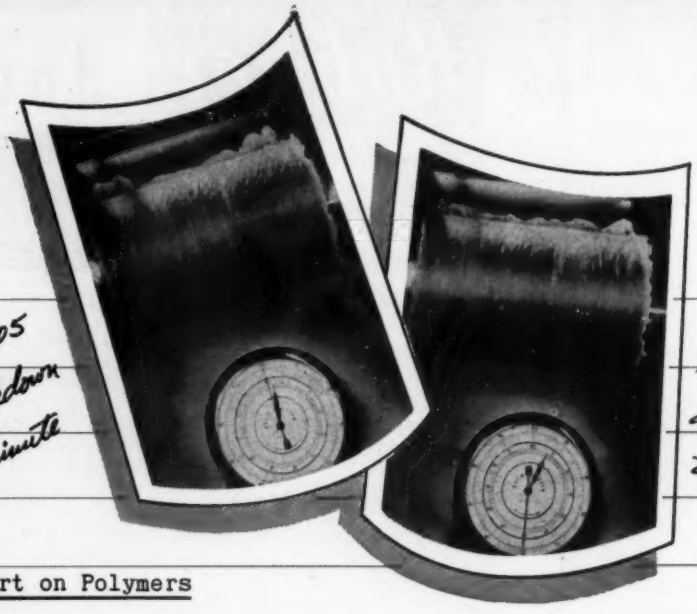

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NOTES of the WEEK

A Record Year

IT will be some time before the actual figures are known but there is already ample evidence that the past year has been a record one for the UK rubber and plastics industries from the point of view alike of manufacturers and the suppliers of the raw materials. In the field of rubber, the latest returns show that the third quarter total for 1959 for rubber manufactures (tyres and other uses) was 60,191 long tons, with the total for the first half of the year of 128,949 long tons. Particularly notable has been the increase in the use of foam rubbers, both natural and synthetic. It is already clear from the figures for the third quarter of 1959 that the record level of production of plastics materials achieved in the second quarter was being maintained, and there is no reason to suppose that there has been any cut-back. If the figures for the July-September quarter, which, as indicated above, were lower than in the April-June quarter, are multiplied by four, a figure of 487,000 tons is obtained for the total of all plastics materials produced during 1959. This figure may not be far out but it is by no means impossible that it has, in fact, been exceeded and that for the first time the half-million ton mark has been passed. It is worth noting in passing that in the USA, according to Rubber Manufacturers' Association estimates, 1959 has also set up new records. New 1959 peaks, based on ten months of actual record, are likely to include that for consumption, 1,615,000 long tons of new rubber (against the previous record of 1,529,699 in 1955) and for consumption of synthetic more than 1m. long tons (925,879 in 1957).

Possibilities

TURNING from a backward look to a forward glance, it seems likely that 1960 will bring with it to UK industry in general quite a number of problems. If Europe is split, even though temporarily, into two trade blocs, the European Free Trade Area and the European Economic Community, these problems may indeed be formidable. If anything is certain it is that all our industries will have to face increased competition and in all probability some changes in trading patterns. In this connexion, a report on ' Tariffs and Trade in Western Europe,' published this month by Political and Economic Planning, is of interest. It presents a detailed comparison of the tariffs of the twelve main industrial countries of Western Europe, and the future external tariff of the EEC, which is a useful aid to the problems involved in linking together the customs union of the EEC and the EFTA countries. The report's tables also give some indication of the probable contribution the removal of barriers can make to the expansion of trade. Under EFTA arrangements, there is to be, on July 1 1960, a 20% cut in tariffs and a 20% increase in non-agricultural quotas. At the same time, the EEC is to make its second 10% cut in inter-community tariffs. The PEP publication points out that once the common EEC tariff comes into operation, and unless reductions are made in the interim, Britain will be left with the highest average ' most favoured nation ' tariff of the larger European countries. The rest of EFTA will therefore enjoy corresponding advantages for their exports of manufactures to the UK—though in some they will have Commonwealth competitors who already get duty-free entry to the British market. Sectors where British exports will enjoy a substantial advantage include motor vehicles. However, on a wide range of manufactures many of the other members of EFTA charge either a very low tariff or none at all, and in almost every sector of manufacturing industry the tariff advantage that the other members of EFTA will enjoy in in the UK market will be considerably higher than that which the UK will have in the rest of the EFTA market taken as a whole.

Tariffs

ONE general point about the PEP tables is that the UK mfn tariff on manufactured goods is in many cases quite close to the EEC common tariff. For example, on passenger cars EEC tariffs range from 17 to 45%, averaging 27 to 29%. The UK tariff is 30%. On radio and television sets, EEC tariff, averaging 21 to 23%, is only slightly higher than the UK tariff of 20%. In the important engineering sections generally, either the UK tariff and EEC common tariffs are close or else the product is on list G where a rate has still to be negotiated. Plastics materials and rubbers are used in so many industries, cars in particular, that these are significant figures. Sectors where the UK tariff is considerably higher than the proposed EEC tariff include synthetic organic chemicals and man-made fibres. In these high tariff sectors, the UK does not obtain a large proportion of its imports from non-OEEC sources, so that whether or not there is to be free trade throughout Europe it is of more direct concern to British industry than the level of the UK tariff against non-European countries. Speaking the other day, Mr F. J. Erroll, Minister of State, Board of Trade, told of UK aims for the abolition of trade barriers throughout Europe. Only in the wider free trade area, in which full advantage of modern scientific and technological advances is taken, can strength and prosperity, he said, be further enhanced. It remains to be added that in both the rubber and plastics industries the view is held that 1960 will see strong healthy conditions.

NEWS *Briefs*

SWEDISH TYRE PROJECT—FIRESTONE SALES RECORD—PAKISTAN RUBBER—SOUTH VIETNAM JAPANESE IMPORTS — CANADIAN VINYL PLANT

●**United States**—Although natural rubber will continue for the present to comprise half the world rubber market, it will gradually be displaced by synthetic and modified natural rubbers, two scientists from the Battelle Memorial Institute, Ohio, said in New York last week. In an article published in the Battelle Technical Review, the scientists said that as a result of the final preparation of synthetic rubber in 1954, the world will no longer be dependent on the supply of natural rubber, now centred in areas such as Ceylon and Sumatra.

●**Japan**—Japan's November crude rubber imports totalled 10,302 tons, worth 7,939,000 US dollars, according to the Japanese Customs House. This represents an increase of 17.2% or 1,544 tons over the figure for October, but is still 1,091 tons below the 11,393 tons imported in November 1958.

●**Israel** — Israel intends in future to make all her natural rubber purchases directly in the rubber producing countries instead of on the London market as hitherto, it is reported from Jerusalem. The move is designed to increase the volume of trade between Israel and Africa and Asia, and to provide cargo for Israeli shipping lines operating in these regions. Ceylon, the Belgian Congo and Liberia are considered as possible sources for the purchases.

●**West Germany** — Formation of a jointly owned German company, Pigment-Chemie GmbH, for the manufacture and sale of titanium dioxide pigments has been announced by Sachtleben AG of Cologne and E. I. du Pont de Nemours and Co. of the US. The initial capital of the company is DM35,000,000 ($8,330,000) of which Sachtleben will own 74% and Du Pont will own 26%.

●**Canada**—Armstrong Cork Canada Ltd. has announced that it is to construct production facilities for the manufacture of vinyl plastic flooring at its Montreal plant. Construction is to begin early next year. A capital expenditure for plant and equipment will be in excess of $2m.

●**United Kingdom**—Glass fibre production will begin in January at a new £750,000 plant at Camberley, Surrey. This is the first phase of an expansion programme by Glass Yarns and Deeside Fabrics Ltd., an associate company of Microcell Ltd.

●**Pakistan**—The 70 rubber trees planted in 1951-2 at Chittagong have already been tapped successfully for rubber. In all about 1,000 rubber saplings have been planted at Chittagong.

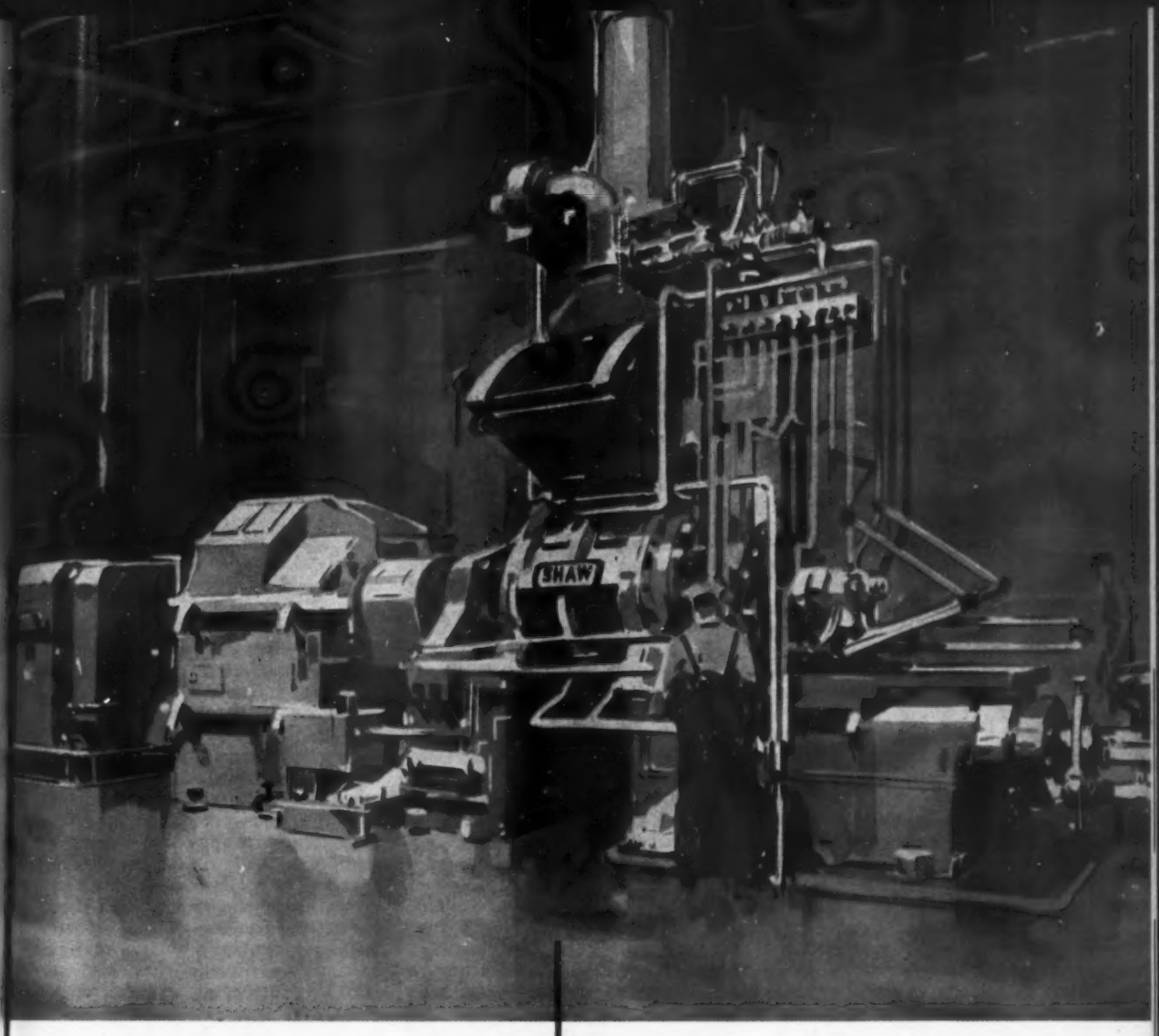
●**United Kingdom** — The Board of Trade has authorized removal of a restriction on members of the Rubber Proofers' Association which had covered a specified standard of quality for the rubber proofing of garment cloth. The standard was laid down by the Board during the war for the rubber proofing of 'utility' cloth.

●**United States**—The Firestone Tire and Rubber Company reported record sales and earnings for the fiscal year ended October 31 despite an eight-week strike last spring in its own plants and recent steel-induced shutdowns of major customers. Firestone's net income for the 12 months was 64,596,848 dollars, equal to 7.48 dollars a common share, compared with 53,751,650 dollars, or 6.23 dollars a share, in the previous fiscal year. Net sales totalled 1,187,784,024 dollars against 1,061,590,801 dollars the year before. The net working capital at the end of the fiscal year was 394,491,835 dollars, up 34,530,675 dollars from a year ago.

●**South Vietnam**—Italy might import large quantities of farm and forest produce — including rubber — from South Vietnam in the future, the Vietnam Press Agency reports. The Agency said this was announced by Dr Carmelo la Rosa, leader of a 15-man Italian trade delegation which left Saigon for Rangoon last week following a short visit. The Italian delegation is in the last stages of a South-East Asian trade promotion tour.

●**Sweden** — The Swedish Goodyear Gummi Fabriks Aktiebolag is to expand its motor tyre producing facility at Noorkoeping at a cost of around 10m. Swedish crowns. Mr Thure Melander, Goodyear's chief of operations in Scandinavia, said the market for tyres was growing fast and in order to meet the increased demand the existing factory building would be expanded at a cost of about 4.5 million Swedish crowns. Machinery and equipment would cost approximately 5.5 million crowns. Mr Melander added that the work of expansion would be carried out in 1960 and be completed before the end of that year.

'About that sensational new plastic you invented — I've got news for you — You've re-discovered celluloid!' —464



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OVERSEAS AGENTS THROUGHOUT THE WORLD

P.2806

International Rubber Conference

ESSENCE OF THE SCIENTIFIC RESULTS

By W. C. WAKE

THE International Conference already reported as organized by the three American societies[1] held its last session on Friday afternoon November 13 when the 72nd paper was read and, very briefly, discussed. As one of the British participants in the meeting I have been asked to attempt an assessment for readers of *RJIP* of the scientific progress reported there. Most of the papers dealt with technology rather than science and these will be reviewed and assessed by another[2] leaving the present writer the difficult task of distinguishing scientific knowledge from technological knowledge, principles of action from useful 'know-how.' Always difficult, this task is increased by the considerable skill in using scientific method shown by many of the authors of the Conference papers and by the frequent use of very sophisticated measurements in technological experimentation. Some papers, too, are part concerned with new knowledge or discussions of principles, and part with the immediate application of these to technology. In such cases overlapping with possible repetition of points, is unavoidable. With this introduction and some misgivings about my competence for the task ahead I start my review which will refer to 19 of the 72 papers, references being given at the end of the article to the titles and authors together with the page in the volume of Proceedings which were issued to the Conference members. Most of the papers are likely to be published subsequently in journals but, since this has been left to individual authors to arrange, publication is likely to be scattered.

Elasticity and Network Theory

One paper only[3] deals directly with this subject and the contribution is very much in the nature of a skirmish with a possible approach to network theory rather than what it claims as 'an exhaustive analysis of the behaviour of various highly idealized network models.' The paper is well written with allowances for mathematical frailty by consigning mathematical detail not needed in the unfolding of the main argument to five fearsome appendices. What does the paper contribute? It considers possible network constructions which are independent of any molecular theories. The first case concerns a one-dimensional array and the authors consider the end-to-end length distribution and hence the force-length relationships. They show that a Gaussian distribution for the probable length leads to a linear force-length relation. Harnessing arrays in parallel is shown to lead to an absurd result if the coupling is perfectly rigid and this is avoided by the introduction of 'sloppiness' in the coupling. This enables a three-dimensional case to be considered though only in a general way. The paper ends with the distribution function governing the separation of any two arbitrarily chosen network junction points in a three-dimensional network system the connecting lengths of which are not mutually exclusive. The distribution is Gaussian.

A second paper[4] deals with the rate of swell of cross-linked networks when allowed to imbibe liquid. This is an important property of a network because it is the one usually used to provide the fundamental information about the molecular distances between the junction points. The experimental method is elegant and should be adopted, if possible, to replace routine weighing procedures. Swelling of a polymer by solvent is, of course, a diffusion process and the authors hope that knowledge of this process will lead to knowledge about the frequency and size-distribution of holes in the network structure and about the sizes of polymer segments which are involved in movement consequent upon the movement of the solvent. They show in an appendix the necessary layout of the theory, ultimately based on Fick's laws, to allow for concentration-dependent diffusion and the consequent necessity to employ two diffusion coefficients. In order to vary the volume swell at equilibrium, mixtures of solvent (cyclohexane) and non-solvent (acetone) were used in experiments with butyl rubber. Surprisingly, the authors state that acetone from such a mixture does not penetrate the polymer even when high swollen by cyclohexane. As the first finding towards their ultimate goal, the intrinsic diffusion is shown to be linearly related to log (viscosity).

Flow Properties of High Polymers

The departure of the flow properties of high polymers from Newtonian behaviour is well known and has led to the use of a number of 'power' laws to express the relationship between the rate of shear and the deformation produced. In addition to deformation, however, some of the shearing energy is stored and can be recovered. Complete description requires statement of both elastic and plastic deformations although most workers separate these effects and concentrate on one only. Eccher[5] attempts total description by using a rheometer to describe the flow and, in a separate experiment, measures directly the elastic response existing under the conditions producing the flow.

The actual shear produced in the rheometer is small and the device allows movements of 2×10^{-3}mm. to be followed; indeed, the total displacement of the centre leaf of the test piece sandwich was kept below 1mm. The author defines his relationships in his first equation without a power law for the viscosity term but for convenience of plotting uses a log relationship for apparent viscosity vs. rate of shear thereby implying by the linearity of the plot the existence of a power law. The results he obtains include several interesting features. Natural rubber, he finds, is virtually Newtonian at very low rates of shear and a yield value does not exist. In view of statements which have been made from time to time it is useful to have this last point once again confirmed. He notes that the viscous behaviour of superior processing rubber dominates its behaviour compared with ordinary smoked sheets where the elastic component is much more prominent. Although measurements are reported on a number of loaded rubbers the author is understandably cautious in relating these to processing behaviour.

Power Law

Another group of authors[6] make direct use of a power law to describe the flow of sealing compositions. Plotting log (flow rate) against the extruding pressure gives straight line plots, the slopes of which are assumed functions of compositions, linear with respect to the polymeric components and the oil but slightly more complicated for wax and ester components which enter both as individual linear terms and also as a ratio of them.

Although this is empirical it works out surprisingly well and it would be interesting to know if it also fitted pressure-sensitive adhesives.

The name of Mooney is inevitably linked with flow studies and to this Conference he has brought a paper[7] showing how his shearing viscometer can be used for measuring slip velocities, slip being important in extruding operations. He acknowledges a debt to Piper and Scott[8] in his method of development which is set out in detail. One unexpected experimental result was the existence of a maximum in the flow velocity (*i.e.* slip) as a function of shear. The importance of this paper, quite apart from this interesting phenomenon, is that it provides the analysis to enable slip measurements to be made with ordinary Mooney viscometers and presents an easy method of obtaining and representing the results graphically.

Dynamic Properties

Two papers are important for their approach to dynamic aspects of the usual tensile properties of rubbers, the first[9] dealing with the effect of rate of straining on the simple stress-strain relationship which is investigated with the comprehensive thoroughness I associate with my friends at Leverkusen. Their paper starts with a review of the Mullins effect and its consequences and then deals with the influence of temperature on the shape of the stress-strain curve. More interesting perhaps than the diminution in the area under the curve which occurs with increasing temperature is the change in shape as the temperature is lowered. Also at lowest temperature is the growing importance of the fact that the deformation caused by the application of tension is an adiabatic phenomenon. Velocity studies involved the design of special apparatus with elongation rates (ring test pieces) up to 200cm. per sec., the signature being obtained electrically on an oscilloscope. The results are illustrated by 19 graphs and eight three-dimensional diagrams. Two points call for comment: Tear strength for natural rubber shows a surface (tear / temperature / rate) totally different in form to that for SBR. It would take too long to describe the difference but it is obviously important and is immediately apprehended from the three-dimensional diagram (Fig. 16 of the paper). This leads the authors to the second point, namely that abrasion tests must be a function of velocity of deformation and of temperature.

The second paper[10] also concentrates on tear and investigates a range of temperature and rate although more limited in this respect than the previously mentioned investigation. It would seem that crystallization of natural rubber which seems important to be tensile properties at high elongations is not involved, or at any rate is not so important, in fibrous tearing. This is in agreement with other thought on the subject as will appear later in this review.

Dynamic Testing of Polymers

A short paper by Berger[11] seems to me to have an importance out of all proportion to its length. It applies a new physical principle to the dynamic testing of polymers by introducing a 'step function;' introducing an analogue computer it uses a new method of applying the results obtained. A force is applied rapidly to the system and held. This is known as a step force to distinguish it from an impulse which is a force applied rapidly and then rapidly removed so that the time of application or 'dwell' is as short as possible. The response of the system to the step force is obtained by a strain-gauge and the usual electronic black boxes. The observed responses are analysed by step function analysis which was originally applicable only to linearly responding systems but the mathematics have now been extended to non-linear systems and can therefore be used for rubbers. The final stage is feeding the parameters obtained in to an analogue computer and, at the same time feeding any force function for which data is required. The answer that comes out is the required deformation curve corresponding to the force function. Designers and engineers will undoubtedly be worrying their managements for analogue computers and the investment should be worth while!

Abrasion and Tyre Wear

The new attention which is being given to the behaviour of that part of a tyre in contact with the road is, I believe, due in no small measure to fundamental work on friction and on abrasion carried out in British laboratories, and, as no paper on the subject can now avoid acknowledgment to Schallamach in its references, it is fitting to begin with his paper[12]. This author firstly discusses the mechanism of slip and demonstrates that *slip* can exist without *sliding* occurring and gives the name of 'crab-walk' to the phenomenon. This does not deny the occurrence of sliding in real conditions but shows that when conditions are fixed so that the coefficient of friction is virtually infinite, slip occurs but sliding does not. With a finite coefficient sliding also can take place and does so with a solid rubber wheel near the rear edge of the contact zone. Slip cannot cause wear; sliding does. Sliding is caused by the retraction of the stretched rubber when the retraction force exceeds the force sticking it to the ground. These simple ideas lead to a theory for slipping wheel abrasion machines. Secondly, the author deals with hysteresis. A rubber with high hysteresis losses will retract more sluggishly and with less energy. Sliding, I have said, is caused by retraction and wear is caused by sliding. High hysteresis is therefore preferable—other things being equal. But, of course, they are not equal and Schallamach ends this paper, as remarkable for its lucidity as the elegance of the experiments reported, with the sobering thought that 'lengthening the life of a tyre by increasing its hysteresis has to be paid for by an increased fuel bill." Did the physicist or the philosopher write this last sentence?

The authors of the other papers also concern themselves with movement of the tread rubber and its effect on tyre wear. The first of these[13] considers in detail the mechanics of tread movement on the road and gives contour plots of the contact areas of tyres and road. The authors relate these contour plots to actual slip and stick-slip motion of the tread and to the appearance of the now familiar abrasion ridges. The last paper[14] deals explicitly with abrasion and sets out the equation of motion and boundary conditions for an elastic body moving over irregularities. According to the author, movement of the body over an obstacle can be a form of stable or unstable 'flow,' depending on the velocity. This leads to the prediction of regions where abrasion does or does not occur and in its final sentence joins hands with the first paper mentioned in that the authors refer to 'the amount of rubber actually lost in the unstable region' depends on 'the ease with which . . . it ruptures rather than snaps back. Because of the underlying unity of this idea that abrasion is in one sense caused by low hysteresis (the rubber snaps back with full energy and thus abrades) and is minimised by high hysteresis I have left to this point another paper on tearing[15]. In this, the leader of the group to which Schallamach belongs, reviews the recent work of himself and the group. Hysteresis is again a key word and the author shows that relaxation processes effectively determine the energy required to tear unfilled rubbers. Increased hysteresis gives increased resistance to tear. It does so also with the reinforcing fillers (though this is not true of other

fillers) where a softened zone precedes the propagation of the tear which actually occurs at the discontinuity between softened and undisturbed zones. Electron microscope evidence shows the tearing zone to proceed preferentially at an irregular surface which includes much of the rubber-carbon black interface, the rubber-filler adhesion being, apparently, a point of weakness.

Rubber-filler interaction is also the subject of a (thesis?) paper from the University of Akron[16]. This paper suggests that the bound rubber, or carbon gel, is not as important in 'reinforcement' as was believed, say, five years ago; that the network it represents is trivial compared with that produced by vulcanization which may include some polymer-sulphur-carbon black attachments. The careful determination and discussion of network parameters and its investigation of the effect of additives, makes this paper of greater importance than the above summary of its tentative conclusions would indicate.

The Chemistry of Cross-Linking

Dealing first with sulphur vulcanization, as is historically just, two papers seem to me to have contributed to our scientific knowledge of the process. Shelton and McDonel[17] try to cut through the process of detailed investigation of the detail of every reaction with each possible compounding ingredient by asking the broad question, 'Is this system essentially polar or essentially free radical in character?' Their method was to examine a number of typical systems and determine the cross-linking as a function of vulcanization time in the absence and presence of additives which would act as free radical scavengers. They also included among their systems dicumyl peroxide vulcanization because it is known unambiguously to be radical in nature and this provides a standard for comparison. In SBR, and presumably in other unsaturated elastomers, unaccelerated sulphur and guanidine-sulphur cures are known to be polar in mechanism. The following systems are thought to be predominantly polar:

Thiuram disulphide—sulphur (but not sulphurless TMT)
Dithiocarbonate—sulphur
Thiazole—sulphur.

There is, undoubtedly, a mixed character about vulcanization with sulphur when accelerated by thiazole disulphide or sulphenamide. I commend this paper not least to future examination candidates. It clarifies quite a number of things! Although dealing primarily with the technological problem of the state of cure, a contribution from Leth Pederson of Denmark[18] is of interest both for its employment of a radio tracer (S-35) and for its discussion of sulphur and crosslink distribution in TMT-Sulphur vulcanizates.

Peroxide Vulcanization

Two of the friends I made at Wilmington when I visited there have given an authorative review of work[19] carried out by themselves, their colleagues and others on peroxide vulcanization; this is timely. Dicumyl peroxide decomposes thermally by scission between the oxygen atoms giving two identical free radicals which can further decompose to give methyl radicals and acetophenone. Abstraction of a proton from elsewhere by the primary radical gives dimethylbenzyl alcohol. The possible stable end products are, therefore, methane, ethane(?), acetophenone, and dimethyl benzyl alcohol. The position can, however, be more complicated than this due to changes brought about by absorption into carbon black when this is present. Ignoring markedly acid conditions, the primary process seems unaffected by the environment but the ratio of ketone to alcohol in the end product is sensitive to environment for reasons which are not fully understood but which seem to relate to the ease with which surrounding molecules relinquish hydrogen. Acidic environments alter the nature of the primary process from homopolar scission to one producing polar fragments and these do not lead to cross-linking. Hence the depressing effect of acidic blacks and some silicas on the efficiency of cross-linking.

The cross-linking, it will be realized, can be due either to the cumyl-oxy or to the methyl radicals and the evidence suggests that the former are more important with natural rubber and SBR and the latter for silicone rubbers; polythene lies somewhere in between these extremes of behaviour. The authors also discuss the behaviour and use of additives but as these follow an expected pattern their importance is technological rather than scientific.

Cross-linking of the fluorinated elastomers is technically difficult and has usually been achieved as the result of trial and error methods. A paper[20] on the mechanism of cross-linking a copolymer of vinylidene fluoride and hexafluoropropylene (Viton A, E.I.du Pont de Nemours) is therefore very welcome. The process which is outlined is one of dehydrofluorination of the vinylidene fluoride portion of the polymer giving rise to unsaturation. To these double bonds difunctional reagents such as diamines or dithiols add, thus forming some cross-links. These points of addition introduce some instability into the molecular chain and further dehydrofluorination occurs giving conjugated double bonds which react, probably by Diels-Alder addition, with other, singly occurring, double bonds to give further cross-links and thus to stabilize the molecule.

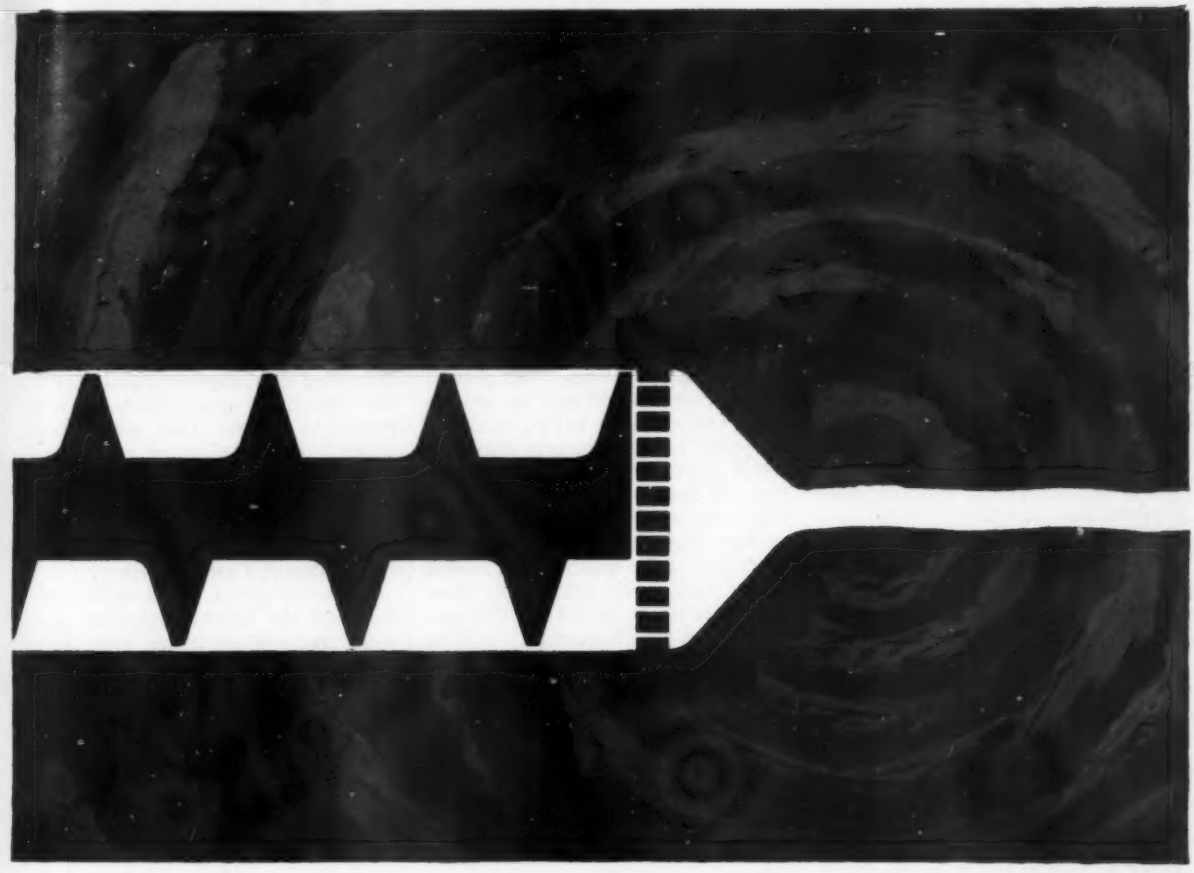
The Chemical Structure of Polymers

A number of papers are of importance to those interested in the actual chemical structure of polymers and its influence on properties. Thus, Cuneen[21] shows how radical addition at a double bond produces a composite radical with free rotation where the spatially fixed double bond existed, which by loss of the added radical (one of two possible steps) regenerates the double bond. Because of the chance of free rotation during its existence as an adduct, the regenerated double bond may have a cis or trans configuration. Hence whichever is used as a starting product, an equilibrium mixture can be obtained, but alas, gutta cannot be manufactured from rubber for the equilibrium mixture is, roughly, 50-50. A small amount of trans configuration can, however, be introduced into natural rubber to give the technical advantage of very slow crystallization at sub-zero temperatures. The structure of chlorosulphonated polythene (Hypalon, E.I.du Pont de Nemours) is reported on in detail[22]. The major weapon employed in this work was kinetic analysis for chloride type following the techniques developed by Salomon and his colleagues in 1948[23] and later. The polythene used is high pressure polymer and is, therefore, branched but not unsaturated and the product obtained contains 31% chlorine and 1.2% sulphur. The paper considers the occurrence and distribution of the following functional groups.

Sulphonyl chloride—1gp. for each 100 carbon atoms, 2% of those attached to primary carbons and 98% to secondary.
Chlorine—18 atoms for each 100 carbon atoms.
Distinguished as — a. Primary, secondary, and tertiary chlorides (secondary is the largest proportion as would be expected).
b. Whether the secondary chlorides are 1, 2, or 1, 3 dichlorides.
c. Proportions of chloride near (S/O_2Cl) groups.

The last paper I propose to mention deals with the structure and properties of two exotic tin containing polymers[24]. I refer to poly (tributyl-

Continued on page 860



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PTFE Lined Pipes*

MANUFACTURE AND APPLICATIONS

IN the chemical processing industries of the USA the over-all problem of corrosion used up some $8,000m. in machinery and maintenance every year, said Mr T. R. Thierry in a lecture given in London recently by arrangement with BTR Industries. Corrosion, he added, was a major problem facing us today.

There were now available on the market various types of piping that were being used in an effort to halt corrosion. However, virtually none of them was universal.

Many familiar with polytetrafluoroethylene when it was first introduced more than ten years ago, realized that a material so chemically inert and thermally stable was almost as inert to the conventional processing techniques used for other plastic materials. Since its viscosity above its melting point was about one million times greater than other thermoplastics, it did not exhibit the characteristics of plastic flow in its molten condition, and, since there was no known solvent for PTFE, it could not be dissolved. Other techniques had to be developed which somewhat resembled those used with ceramics.

Resistance

The value of a PTFE-lined piping system was that not only was it resistant to temperatures up to 260°C. but it was unaffected by almost all chemicals and was almost universally useful for corrosion-proof service. It was completely unaffected by all chemicals except molten alkali metals, and free fluorine at elevated temperatures and pressures. It had better resistance than other plastics or elastomers to fluorine at ordinary temperatures. It was the most thermally stable organic compound known having a continuous useful temperature range from −72°C.—where it is still flexible—to +260°C. Even at a temperature as low as −238°C. PTFE was not actually brittle, since it still had some elongation. It could be used for shorter periods in certain instances up to its crystalline melting point of 326°C. where its rate of decomposition was only three ten thousandths of 1% per hour. A decomposition of one half 1% per hour was not reached until around 480°C.

Fabrication

Fabrication started with virgin PTFE granular powder. This powder was first compressed into the desired form, followed by a baking or sintering cycle at temperatures above its melting point. The individual particle size and shape of the powder was an extremely important factor in determining strength and other physical properties of the final product as well as the uniformity with which these properties can be obtained. The particles in all PTFE granular moulding and extrusion powders of different particle sizes had feather-like fingers extending from their surfaces. In order to obtain the density necessary for achieving optimum physical properties, a critical pressure must be applied uniformly throughout the entire cross-section of the preform.

This critical pressure must assure that the powder in the preform was compacted so that the feathery fingers of each particle formed as tight a matrix as was theoretically possible. If the die-cavity was not uniformly shaped, or if insufficient pressure was exerted, the matrix would be opened, resulting in final porosity. If excessive pressure was applied, a shearing action might occur between charges, resulting in fine cracks or cleavage planes in the final fusion.

Because of the extremely high melt viscosity extrusion of PTFE granular powders was generally accomplished by ram pressure rather than screw pressure. It was therefore not really a continuous process but a series of moulding operations performed by ramming individual charges into a heating zone on an automatic cycle.

This combination of factors coupled with the high bulk density of the PTFE powder generally limited extrusion of tubes in the relatively larger sizes required for lining pipe to heavy wall thicknesses averaging about ¼in.

In order to provide a method of extruding cross-sections below ¼in. thickness, and in particular, for wire insulation, Du Pont had developed a very fine PTFE known as Teflon Six. The fineness referred not only to the particle size, but also to the extremely fine texture of the fibres of the particles. This powder had a much greater tendency to pack than previous powders.

It was therefore necessary to compound this powder with lubricants or solvents to process in a paste or lubricated state. However, since PTFE was essentially non-wettable, it still packed or lumped when mixed with solvents or lubricants and most other liquids. This also complicated the problem of trying to get a uniform extrusion.

Importance of Carbon Black

A process patent issued to Resistoflex, said Mr Thierry, contended that more uniform extrusions with high strength, ductility, and flex-life could be made by incorporating a very small amount of carbon black into the lubricated compound. The actual amount was only a small fraction of 1% or no more than some of the impurities or reactant products in the PTFE polymer, which was commercial PTFE and not chemically pure in a pharmaceutical sense. As a result Resistoflex Fluoroflex-T tubing was characteristically black because of the compounding introduced.

Mr Thierry went on to outline the difficulties of ensuring that the lining stayed locked inside the pipe over a wide range of process temperatures and of overcoming the thermal expansion difference of approximately ten to one between the PTFE liner and the steel pipe. The method for lining pipe used by Resistoflex was based on the use of controlled tension regardless of size or length. As the temperature of the process stream increases, all the way up to 260°C., the liner tended to overcome its inherent tension without elongating. At the same time, the liner resisted collapse under negative pressures by attempting to expand diametrically within the housing. This caused the liner to lock itself more tightly in place as the temperature increased.

Mr Thierry went on to outline some of the applications of PTFE and described Fluoroflex-T.S. pipes, liners, fittings and hoses.

Mr T. H. Miller has been appointed to the board of Tali Ayer Rubber Estates in the place of Mr A. H. Throssell who has retired.

** By T. R. Thierry, manager, technical sales and service of the Resistoflex Corporation, of Roseland, New Jersey. This article is based upon a lecture which Mr Thierry recently gave in London by arrangement with BTR Industries Ltd., the sole manufacturers of 'Fluoroflex' in the UK.*

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IRI — PI Symposium

MANCHESTER MEETING

THE Institution of the Rubber Industry (Manchester Section) and the Plastics Institute (North-western Section) in collaboration with Newton Heath Technical College held a joint symposium on extrusion on December 4 at Newton Heath Technical College, Hague Street, Manchester.

Mr J. K. Elliot, Chief Education Officer of Manchester, presenting a prize to Mr E. Weatherstone at the Joint Symposium on Extrusion held by the Manchester section of the IRI, and the North Western section of the PI. Mr E. Weatherstone also gained First Prize in the IRI Associateship examination

Papers presented were 'Basic Design Principles of Rubber and Plastic Extruding Machinery' by E. Morris, A.M.C.T.(Mech.)E., A.M.C.T.(Struct.)E., M.I.Mech.E., F.I.R.I. (Greengate and Irwell Rubber Co. Ltd.). 'Extrusion of Elastomers and Thermoplastics' by W. S. Penn, B.Sc. (Johnson and Phillips Ltd.), and 'Effect of Die Design on Melt Flow' by P. L. Clegg, B.Sc., Ph.D. (Imperial Chemical Industries Ltd.).

At the start of the afternoon session, Mr J. K. Elliot, Chief Education Officer of Manchester, presented awards and certificates to Newton Heath Technical College students of rubber and plastics.

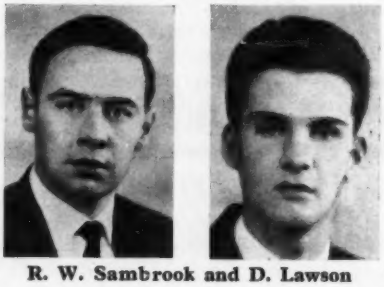
Mr J. K. Elliot, Chief Education Officer of Manchester, presenting a prize to Mr J. W. Longley, who was also awarded the Silver Medal of the City and Guilds of London Institute in the Final Technology of Plastics

'Rubber Journal' Prize

1958/59

THE 'Rubber Journal' prize of £25 for a student at the National College of Rubber Technology, has been jointly awarded for the session 1958/59. The two recipients are **Ronald William Sambrook** and **Donald Lawson.**

Mr Sambrook was educated at St. Michael's and the Priory Grammar School, Shrewsbury, where he gained four subjects at the Ordinary Level of the General Certificate of Education in 1953. He later attended Shrewsbury Technical College as a part-time student, gaining chemistry and physics at the Advanced Level of the GCE, the Ordinary National Certificate in Chemistry and the L.I.R.I., whilst in the employ of the Research Association of British Rubber Manufacturers from 1953-57. He joined the National College of Rubber Technology as a student in the three years' full-time Associateship course in September 1957, for which he was awarded a Greengate and Irwell Rubber Company's Exhibition. He is interested in all sports and an active participant in soccer, being chairman of the Northern Polytechnic Soccer Club.



R. W. Sambrook and D. Lawson

Mr Lawson was educated at Baines Grammar School, Poulton-le-Fylde, Lancashire, where he obtained nine subjects at the ordinary level of the General Certificate of Education in 1954. In the autumn of 1955 he joined BTR Industries Ltd. at Leyland, who seconded him to the National College of Rubber Technology for the full-time Licentiateship course commencing in September 1956. On the successful conclusion of this course, and having gained the L.I.R.I. and L.N.C.R.T. in 1957, he passed into the three years' full-time Associateship course, under the sponsorship of BTR Industries Ltd. Mr Lawson is a keen tennis player and a member of the Northern Polytechnic team.

∴ The 'Rubber Journal' Prize is awarded to the student, under 25 years of age, who has enrolled in the three-year Associateship course, attained at the end of the second year the highest standard in practical rubber technology, and who will continue to attend for the third year of the course.

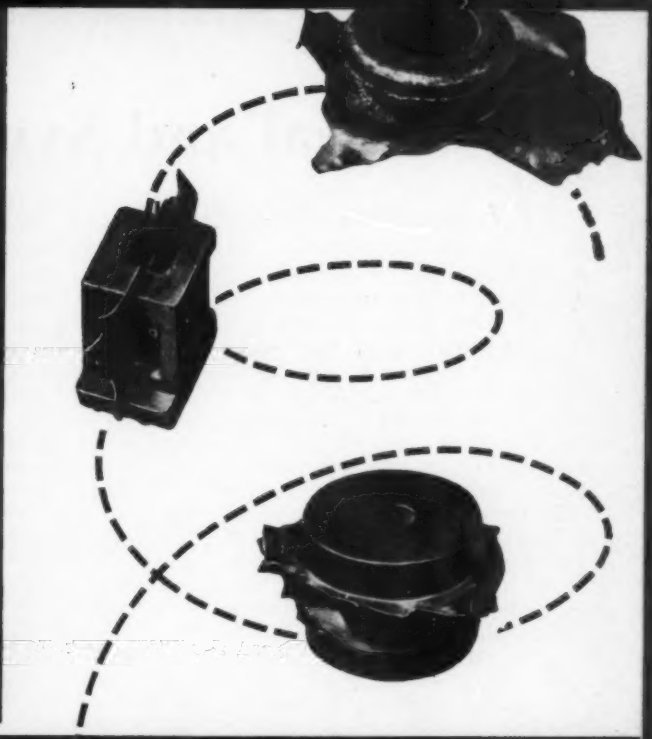
SYNTHETIC RUBBER PRICES UP

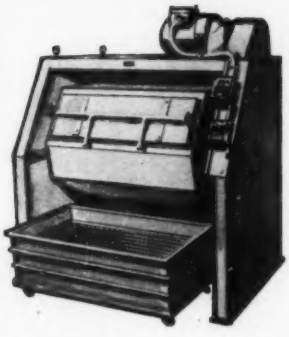
New prices for the International Synthetic Rubber Co.'s Intol Rubbers have been announced. These came into force on December 17 and are now on a free-delivered in the UK rather than an ex-works basis, and are as follows: Intol 1500/1502/1006, 22.5d. per lb., Intol 1710/1712, 18d. per lb., Intol 1778, 18.25d. per lb. For the convenience of those who prefer to purchase ex-works or ex-Manchester store, the company will supply at a price ¼d. less than the delivered price for each grade. In view of the large variation in carriage costs on latices, prices of Intol Latex R.23/M.23 will continue to be on an ex-works basis at 22.25d. per lb. of solids content. Prices of the new high solids latex, Intol Latex 62/A, due in bulk production in February 1960 will be advised later.

Leading US synthetic rubber producers have confirmed that the basic grades of SBR were increased to 24.10 cents per lb. fas from 23.25 cents per lb. around December 15. Trade forces in New York said that the upsurge in the price of natural rubber and the increasing consumption of synthetic rubber there and overseas are the reason for the price advance.

Sir Owen Wansbrough - Jones, K.B.E., C.B., has been appointed a director of the British Oxygen Co. Ltd.

De-flash small rubber parts with 'DRIKOLD' in the Columbian International Sub-zero Tumbler





Sub-zero tumblers are obtainable from Columbian International (Great Britain) Ltd., 116 Cannon Street, London, E.C.4.

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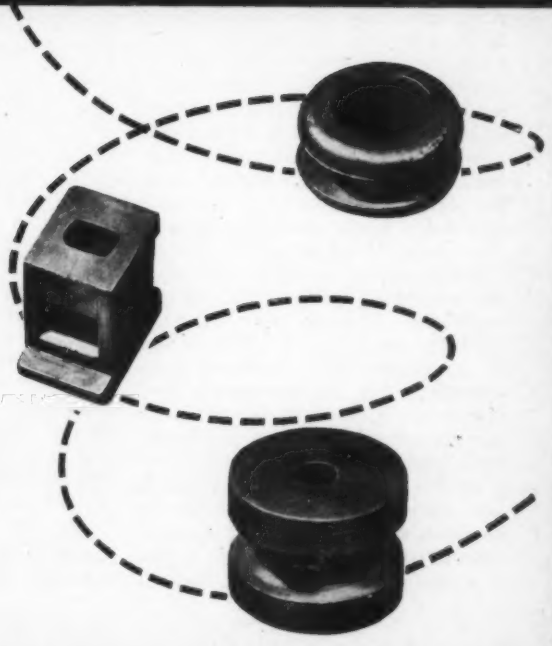
When small rubber components are frozen in a rotating drum with 'Drikold'—I.C.I. solid carbon dioxide—flashes become brittle and the tumbling action breaks them off. Sub-zero de-flashing with 'Drikold' can cut costs, speed processes, increase production. I.C.I. Technical Service staff will advise on problems, and will de-flash sample batches of components on request.



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Natural and Synthetic Rubbers

RECORD ATTENDANCE AT IRI LONDON SECTION MEETING

IT was 'Standing Room Only' for the panel discussion Natural Rubber *v.* SBR which formed the subject of the 7 p.m. meeting of the London Section of the IRI on December 8. The panel, whose names are given below, dealt first with 10 questions which had been submitted in advance and, since further time was available, with a number of interesting supplementary questions. Mr C. H. J. Avons, chairman of the London Section, presided. Members of the panel were:

Dr L. Bateman—British Rubber Producers' Research Association.
K. G. Burridge, M.A., M.Ch.E., A.R.I.C., A.M.I.Chem.E.—International Synthetic Rubber Co. Ltd.
H. E. Davis, F.I.R.I.—Dunlop Rubber Co. Ltd.
W. G. G. Kellett, M.Sc.—Rubber Growers' Association.
K. T. Pickard, A.I.R.I.—Polymer (UK) Ltd.

The questions asked and a summary of the replies are given below.

Mr A. Cooper (Expanded Rubber Co. Ltd.) asked why, with the advent of indigenous synthetic rubber, we had not yet experienced the stabilizing effect on the price of natural rubber which had been confidently predicted in certain quarters. Mr Kellett referred to the heavy buying of NR by Russian and other interests but the main conclusion was that SBR was not a suitable replacement for NR in many applications, the two materials being much less competitive than was suggested previously. Mr Pickard referred to stereospecific polybutadienes which might more nearly replace NR as a tread rubber on account of their reduced hysteresis. Mr Burridge said the law of supply and demand operated. World consumption was now about 3½ or 4 million tons of rubber annually, of which 2½ million was natural, 1½ million SBR and the remainder of other types. In the USA the percentage of SBR used was in accordance with technical considerations, but this was not the case elsewhere. Another important factor was that it took five to seven years to get a plantation into production.

Dr L. R. Barker (BRPRA) said it was claimed that by using SBR the motorist would save money through reduced tyre wear. Was this a real economy or did the motorist, in fact, pay more for increased fuel consumption due to hysteresis losses?

Mr Davis said that taking two typical car tyre sizes for a small and a medium sized car, the following was the position. SBR increased fuel consumption by 3 to 4%, but 10% is gained in rate of wear. If the two rubbers were the same price there was no difference, but on today's rubber prices, it was impossible to produce a natural rubber tyre at the same price as an SBR tyre. Mr Pickard said that a paper, De Deker, Houwink and others, at the 1954 Rubber Conference described careful tests on petrol consumption. For a new car this could vary from 0.2 to over 3% with an average of 1.73% between natural and synthetic tyres. These difficulties were reduced almost to zero as the car got older. If the cost of a tyre was $20, and fuel 40 cents per gallon, the increased fuel cost with SBR was 2%. Over 20,000 miles the extra fuel cost was $8, but the extra cost for the tyre would be $12, so that the motorist was $4 better off with the SBR tyre. Dr Bateman remarked that statistics could prove anything but you could not produce elastomers with both improved hysteresis and improved wear rating since these involved opposing structural requirements.

Hot Tear Strength

Mr E. O. Shead (P. B. Cow and Co. Ltd.) asked whether the hot tear strength of non-black SBR compounds could be raised to that of natural rubber compounds?

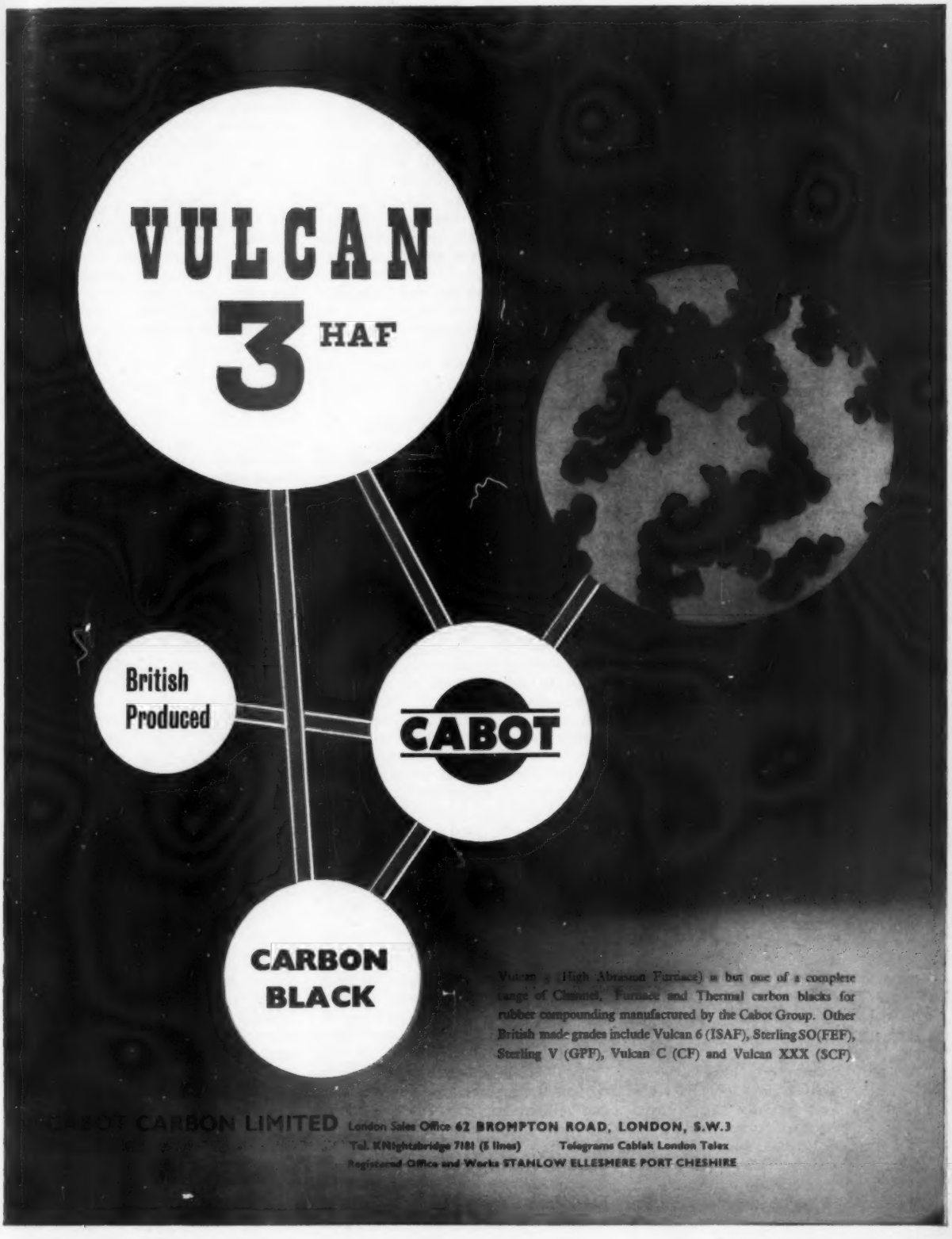
The panel gave him little to hope for. Mr Pickard said that non-black SBR had low tear strength. A change of polymer structure was required to dissipate strain. Fifteen to 25 parts of coumarone resin could help, however. Silica fillers increased tear strength but reduced the elongation at break. What was needed was a reduction in modulus. The position might be summarized by saying that it could not be done at present, but new polymers which may enable it to be done were on the way. Mr Davis agreed and added that careful control of cure could help. In the past it was customary to cure optimum hysteresis; now the criterion of cure was optimum tear strength.

Mr D. E. Partington (Enfield Cables Ltd.) requested the panel to compare the extrusion rates of oil extended SBR and NR with particular reference to continuous vulcanization compounds? By what means might an oil-extended SBR CV cable sheathing be cured in 10 seconds at 200°C. he asked.

Mr Pickard said that in general, oil-extended polymer had a slightly slower cure rate, but a direct comparison with natural rubber was not possible since the nature of the fillers and other ingredients was different in the two cases. Specifications for electrical goods based on tensile strength instead of performance were worthless and placed the compounder in a difficult position. Unhindered by such specifications, satisfactory SBR compounds could be made. The time of cure stated in the question meant, using the normal 200ft. tube, an extrusion rate of 24,000yds. per hour (1,200ft. per minute), and it was not believed that anyone was doing this. A 15 or 20 second cure was, however, possible at 200°C. It could be obtained by combining OEP with 3% bismate and 2% sulphur. An alternative combination was three parts OXAF, 1.7 sulphur, and 1.5 Monex. In any case, sheathing sections were thicker and, due to difficulty of heat transference, could not be cured as fast as insulation. For insulation, speeds of 10 to 12 thousand feet per minute had been claimed in the USA but for sheathing 400ft. per minute was probably the limit at present. Mr Davis added that OEP had been found definitely slower in extrusion. It ran hotter which limited acceleration. The shortest laboratory cure time had been 1½ minutes at 117°C.; an equivalent natural rubber compound could be cured in 20 seconds. Using Santocure with TMT or ZDC, the physical properties of cured SBR were poor and factory processing difficult, but on one job the difficulties had been overcome by using a blend of natural and SBR in equal amounts.

Mr E. O. Shead was interested in rapid moulding cycles at 150°C. (300°F.). Might the cure times of SBR compounds be as short as for natural rubber?

Mr Burridge said that in general, SBR did cure more slowly. The structure was of three butadiene units and one styrene unit, instead of four isoprene units. In addition, the point of unsaturation of SBR was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rather vulnerable. It was, however, less liable to scorch. Nevertheless, the compound could be suitably adjusted. Dr Bateman mentioned that it was not within his terms of reference to tell anyone how to use SBR. Mr Davis said the answer depended on the dimensions of the article and the permissible cure time. For, say, a 10 minute cure SBR was suitable, but if a natural rubber cure of, say, 1½ minutes was in question this could not be matched by SBR. Mr Pickard stressed that it was being done. Manufacturers were moulding mechanical goods at the same rate as when using natural rubber but special accelerators were required and, in general, higher loadings.

Gum Vulcanizates

Dr G. Bielstein (B.I.C.C. Ltd.) asked for the conditions for optimum tensile strength of gum vulcanizates in terms of their cross-link density and a comparison between SBR and NR in this respect? Also would fillers other than carbon black affect this comparison.

Dr Bateman explained the reasons for this optimum occurring at a much higher cross-link density for SBR as due to the reduced crystallinity of the latter, the cross-links being the only 'knots' in the structure whereas with NR, crystallites were formed when the rubber was stressed and excessive cross-linking led merely to brittleness. Mr Pickard drew attention to the important influence of the initial molecular weight of the polymer and Mr Burridge added that the gum strength of SBR was of no technical importance. It was only in carbon black mixes that the two rubbers were comparable. SBR needed a fine reinforcing filler and less sulphur than natural rubber, the optimum ratio generally being 3:4.

Mr G. Martin (BRPRA) asked the panel to indicate what information was available about the variability of natural rubber and SBR in tyre tread and similar stocks.

Mr Davis replied that there was no published information but a great deal of practical experience. In the past natural rubber was always blended, but now very little blending was done because the rubber was less variable. This was due to improved methods at the packing stations, the blending was, in fact, now done there. SBR was just as variable as natural rubber, even from the one producer. Baker has found a natural variation of 425 psi in modulus on various lots of natural rubber. In one series of tests SBR gave figures between 800 and 1,200, *i.e.* the variation was about the same as for natural rubber. Normally, however, natural rubber showed less than the maximum variation found by Baker. Mr Burridge said the variability of SBR could be improved. Specifications which allowed a variation of 400 psi in modulus were laid down some years ago. In general, if manufacturers said what they wanted the producers of SBR could do something to meet their wishes. Mr Davis added that the specification mentioned was for the old war-time type of GR-S. The test formula used channel black and MBT. Such a mix might show up differences but was no longer used, for present day compounds were based on furnace blacks and sulphenamide accelerators.

Mr R. H. Sudekum (Minnesota Mining and Mfg. Co. Ltd.) asked the panel to compare the 'ageing' properties of unvulcanized or partially vulcanized Natural Rubber and SBR in such products as adhesives and paper saturants.

Mr Burridge said in the case of cured compounds SBR tended to cross-link on ageing and natural rubber to break down. Many polymerization recipes for SBR contained iron and this could affect ageing adversely. Iron was more important here than copper or manganese. With light, SBR was perhaps a little better than natural rubber. Dr Bateman reported that his colleague, Mr Popham, some years ago was concerned with the manufacture of Rubbone where cellulose was used as an oxidation catalyst. Cellulose was short during the war so old telephone directories were used. After straining off the cellulose a residue remained which sometimes caught fire. It was found that when red telephone directories were used the mass caught fire, but with blue telephone directories it did not. Mr Pickard said that high (50%) styrene latices could be used satisfactorily without subsequent vulcanization.

Surplus Production

Mr G. Martin mentioned that until recently, the natural rubber industry had been faced with the problem of surplus production. Was this likely to recur in the near future?

Mr Kellett said that in the 1930's consumption never rose much above one million tons per year, but since the end of the war it has risen to about four million tons per year. The manufacture of synthetic rubber in Communist countries must not be overlooked. The rubber manufacturer had had incentive to use synthetic; the minimum demand for natural exceeded the output of the normal producers. So long as over-all consumption continued to increase the present position would continue, but even if the price fell there might still be a surplus with competition only on price. Mr Davis said that no prospect of a surplus could be seen. There had been very little new planting of late, although Dunlop had done some planting in West Africa. The Indonesian supply might be lost through political considerations.

The final tabled question came from Dr J. N. Milne (Du Pont (UK) Ltd.) who wanted to know what effect a commercial synthetic polyisoprene would be expected to have on the relative economics of NR and SBR. Mr Burridge asserted hopefully that the prime effect would be on NR but Mr Kellett pointed out that present polyisoprene was not a perfect match for NR, possibly on account of the absence of certain 'non-rubber constituents.' Mr Pickard regarded it as a useful help in bridging the gap between the present supply and increasing demand for NR but drew attention to the unfavourable economics of the large scale production of isoprene for really large tonnages. He produced two balls, one of NR and one of polybutadiene, and to roars of applause he proceeded to bounce them up and down in front of the delighted audience in order to demonstrate the superior resilience of the new rubber, which he obviously felt would sweep the market clean. Encouraged by Mr Pickard's 'more bounce to the ounce' demonstration, Mr Davis looked forward to the wonder rubber which would eventually replace NR and SBR in their entirety. Dr Bateman said that a rubber where all the advantages were present was a dream, for one property could not be improved without another being reduced. The idea of a universal rubber with all advantages was therefore impossible.

The panel having dealt with all the above questions previously submitted, the remaining time was allotted to impromptu questions from the audience.

Dr H. J. Stern said that if one listened to the BBC Third Programme about 11 o'clock, an announcement would be heard that it was closing down. However, if you did not switch off you could hear the Stock Exchange and Market Report, and he had listened to this on the previous night, December 7. The BBC in their Market Report had said that the US Government were unable to sell their 'stockpile' of natural rubber because it consisted of first-grade smoked sheet. Tyre manufacturers, according to the BBC, would not buy this. They would only buy

Continued on page 860

CORRESPONDENCE

UK Belting in Canada

To the Editor

Sir,—I was interested to read on page 742 of the December 5 issue, the comments concerning the position of UK belting in Canada. Speaking as the representative of the British Rubber and Plastics Belting Manufacturers' Association present in Canada at the hearing of the Tariff Board, I feel that your report gives somewhat undue importance to what was, in fact, only one facet of a number of issues involved.

At this present hearing, the Canadian Tariff Board were considering all textile materials at the instigation of the Canadian Primary Textiles Institute, and under the section dealing with textile materials there appeared a reference item No. 610 which is in turn sub-divided into individual classifications, the first of which refers to beltings with an all textile content, *i.e.*, Solid Woven Cotton Belting. Subsequent sub-sections deal with beltings of textile and rubber, and beltings of textile and synthetic resins, etc.

It is doubtful whether in the first instance the Finance Minister had intended that all these items should be considered, or whether in fact it was only intended to direct the board's attention to that item covering belting with an all textile content. However, there seems no doubt that the Canadian rubber industry saw the opportunity provided and acted accordingly by putting in a brief to the Tariff Board supporting the request for increased tariffs on rubber and kindred beltings.

It, therefore, became necessary if we were to protect our exports to Canada and the sales organizations of various British companies established in Canada, to ourselves submit a brief, repudiating the necessity for such an increase, and fighting step by step the claims of the Canadian rubber industries brief.

In fact, this developed into a very interesting exercise to those unfamiliar with procedures in such cases. Referred to as 'hearings,' the procedure actually follows along the lines of a Civil Court, in as much that the chairman of the Tariff Board sits with members of his committee and supported by economists who listen to briefs submitted by opposing factions and to additional evidence brought out via witnesses under the control of counsel. In our own case, as you correctly point out, we had briefed a Mr D. Gordon Blair, of Ottawa, who is particularly familiar with this type of appearance. Some indication of the size of the proceedings can be gathered from the Canadian industries brief which covered some 14 foolscap pages, and some 11 similar pages of appendices tabulating a wide and complex range of figures and other detail. As such a case had not been envisaged in Britain, it was necessary for the writer, together with members of the Canadian staff of British manufacturers, to prepare in the two or three days available, a similar case in support of our own position in the matter.

A copy of each of the briefs* in full is being enclosed with this letter, as it is felt that they are of considerable interest not only to those whose direct concern it is but also as a general exposition of the circumstances which may require to be faced by other trades and in other countries.

Reading through the briefs you will see that your report is but a small part of a much larger whole, but even here it was indicated that any loss of exports suffered by the Canadian rubber industry were in no way due to any action by British manufacturers, and indeed such exports as they had enjoyed were the result of abnormal world conditions following major hostilities and to markets where a continuance of exports could not possibly behoped for.

Other points which came under discussion are well illustrated in the briefs, but mention might well be made of the fact that the Rubber Association of Canada were concerned only about imports from the UK and not so much about vastly greater proportions of imports from the USA. This is no doubt explained by the fact that by far the biggest proportion of the Canadian rubber manufacturers are of American parentage. It may perhaps be wondered, and indeed we took good care to see that people did wonder, why the Canadian industry were going to such lengths to endeavour to penalize a country which was responsible for only something less than 4% of the imports, and which could never be largely increased due to the impossibility of servicing at such a distance the Canadian market in a manner which is necessary and perhaps peculiar to their particular conditions.

The answer is to be found in the fact that British manufactured belting can be imported into Canada at a lower figure than the Canadian manufacturers want to offer, and although the imports are so comparatively small there is no doubt that the price exerts a definite influence on the prices which the Canadian industry feel they can safely quote. We ourselves have no doubt that if the appeal for an increased tariff rate is successful it will be merely used as an umbrella to raise the price of the Canadian produced belting. This very obviously would mean higher costs to the Canadian primary users with decided effect on their own exports with particular reference to logging, paper and pulp, ores, etc.

The ensuing dialogues of counsel and witnesses were interesting and at times amusing. We treated with some derision the very large percentage variations which the Canadians have shown in their brief, and also such phrases as 'sharp upward trends,' etc. When put in their proper prospective of applying to rather less than 4% of the whole such variations became completely insignificant and meaningless.

It is hoped that the steps taken will have a largely restraining effect on any proposed increase, and indeed we are hopeful that the Tariff Board might see that any increase at all is merely going to repercuss on their domestic and export markets.

If, however, there should be no other advantage the experience has been particularly helpful in showing the necessity for vigorous counter attack of any such proposals, and the futility of relying merely on written generalities.

Briefs need to be supported factually and with accurate figures in as much detail as possible, and preferably from the statistical records of the importing country.

Yours faithfully,

D. A. LEES,
Manager: Power Transmission Division.
Greengate and Irwell Rubber Co. Ltd.
Salford, Lancs. 11/12/59.

*These will be referred to in a later issue.—Ed.

A range of Geon PVC coated fabrics with a true-to-life crocodile skin emboss has recently been introduced by Mellowhide Products Ltd., South Molton Street, London, W.1. The photograph shows a pair of ladies' shoes, courtesy of Barretts of Northampton, using this material which combines the qualities of Geon PVC with the attractive appearance of the crocodile effect—at a very reasonable price

VIEWS and REVIEWS

Improved Viton Rubber

A NEW type of Viton synthetic rubber, named Viton B, is said to offer significant improvement in extremely high temperature conditions and in contact with concentrated chemicals, according to the elastomer chemical department of Du Pont (*Rubber Age*, 1959, 86, p. 287).

Heat ageing tests at temperatures in the range of 500 to 600°F. show that properly compounded vulcanizates of Viton B retain more elongation and show less change in hardness and weight than similar samples taken from previous available types. The tensile is about the same, but embrittlement at high temperatures occurs much more slowly, and elasticity is such that service life is twice as long in many applications.

Chemical Resistance

Viton B has exceptional chemical resistance, especially after exposure to sodium hydroxide and nitric acid at 158°F., as well as to red fuming nitric acid, and glacial acetic acid at room temperature, according to the report quoted.

General Properties

This versatile *fluoro-elastomer* has a specific gravity of 1.86, and vulcanizates have a higher modulus, similar elongation at break and higher hardness than the materials based on Viton A.

The tensile is about the same at room temperature and slightly higher at 300°F.

With correct curing agents, the vulcanizates have compression set resistance equivalent to other types; tear is better both at room and elevated temperatures, and can be still further improved by use of a silica filler in lieu of carbon black.

Resilience is about the same as measured by the Yerzley Oscillograph, and static modulus, and effective dynamic modulus are higher, according to Messrs Dupont.

Abrasion and Electrical Properties, etc.

Results of Taber abrasion tests indicate better results with the new type, and electrical properties are also improved especially when a mineral filler is used. Ozone resistance is stated to be excellent.

Solubility

The solubility in a number of highly polar solvents (*mentioned*) allows the use of the polymer in a variety of coating applications, and solution viscosity of compounds is intermediate between Viton A and A-HV. Smooth workable solutions in the range between 20 to 35% solids, can be obtained. These solutions may be cast to form unsupported films or applied as coatings on a variety of substrates, including fabrics and metals.

Figures

The report in *Rubber Age* contains three columns of figures relating to (1) Typical Vulcanizates; (2) Oil and Solvent Resistance, and (3) Chemical Resistance, for which I have, unfortunately, not the space at my disposal for quotation.

Butyl Talks at NYRG

Rubber World for November (1959, 141, 247) covers a report of the autumn meeting of the New York Rubber Group, the technical session of which consisted of three papers on butyl rubber: (1) 'Brominated Butyl and its Applications,' by C. H. Lufter (Goodrich); (2) 'Dynamic Properties of Butyl,' by R. M. Cardillo (Enjay Laboratories); and (3) 'Butyl Rubber in Automobile Tyres,' by R. F. Leary (Enjay). Summaries of these papers based on the *Rubber World* report follow.

(1) Brominated Butyl

The excellent properties of butyl are retained, and some of the troublesome characteristics are eliminated, by the addition of a small quantity of bromine to the polymer, explained Mr Lufter. The effect is to produce a rubber with an increased cure rate, increased compatibility with other polymers, good adhesion to metals, and other rubbers, and the advantages of a polymer with active centres susceptible to new cure systems. Application is seen where adhesion is a problem, *e.g.* tyre interliners and recapping; where cure rate is vital, such as cable jacket, and most moulded parts, where blends with other polymers are preferred, as in white sidewalls, and parts for special chemical resistance; and where new cure systems are used, such as the methylol phenol and dithiol systems.

(2) Dynamic Properties

The second speaker, Mr Cardillo, mentioned that the unusual dynamic properties of butyl are leading to increased usage in a wide variety of applications. High energy absorption or damping is of special interest. The butyl chain is almost entirely composed of polyisobutene with a very small amount of isoprene; this polyisobutene has high chain symmetry and many side groups, and these contribute to the restricted chain movements which account for high damping.

High damping, continued Mr Cardillo, can be used in many applications where controlled elasticity and absence of bounce and recoil are useful. Damping is also useful in control problems, and this factor has led to increasing use in the car industry.

A new test has been developed to evaluate dynamic properties . . . and these studies can be utilized to predict the response of butyl in many new applications. Thus, Mr Cardillo concluded his talk, with a short film which demonstrated a practical application for utilizing the dynamic damping properties of butyl. In this, experimental highway guard rail posts were made of butyl, and, when smashed into by a car doing 55 mph, effectively stopped the car without damage.

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **DR SCHIDROWITZ**

(3) Butyl Tyres

Mr Leary commenced his talk on butyl tyres by showing a 15 minute film on this subject. Stressing the commercialization of butyl passenger car tyres, the film indicated that butyl tyres gave improved traction; a soft ride; no squeal, and excellent ageing. Mr Leary elaborated on these points and mentioned some of the problems which had arisen in the development of the butyl tyre programme; carcass and bead durability, tread wear, and material and construction costs. The speaker indicated how these problems had been solved since 1952 ' to such a degree as to make possible the recently introduced butyl passenger car tyre.'

Kauchuk i Rezina

In the following are a further batch of notes on articles which have appeared in *Soviet Rubber Technology,* the English translation of the Russian journal, prepared by the RABRM under the auspices of the DSIR translation unit, and in collaboration with Messrs Maclaren and Sons Ltd. These notes, necessarily brief, are from *No. 2, July 1959,* of the English version, corresponding to No. 2, Vol. 18 (*February 1959*) of the Russian.

Continuous Manufacture of Rubber Tubing

The ' Continuous Manufacture of Rubber Tubing, Shaped and Other Extruded Articles ' is by B. M. Borelik, V. V. Chelishev, E. V. Malchikova and A. D. Korunova. To meet the demands for tubular and shaped extruded articles a continuous method of manufacturing them must be developed.

Various methods of continuous vulcanization have been described in the literature but it has not been found possible for various reasons (porosity; complete sealing at places where the goods leave the vulcanization apparatus; similar pressure inside and outside the tubing, etc.) Patents (*inter alia*) for continuous vulcanization of extruded articles in long vulcanization chambers with steam at high pressure, and cooling were tried. Such equipment is used for curing cable. Methods have been devised for curing in a liquid medium at high pressures and temperatures, and patented. It has not been found possible to cure *hollow* articles by these methods, as it is not practicable to seal at places where the goods leave the apparatus. It has also been found difficult to create similar pressures inside and outside the tubing, any difference resulting in a flattening or mis-shaping of the goods. An attempt was, therefore, made to vulcanize without pressure under suitable conditions. But this resulted in porous vulcanizates. An analysis of the vulcanization gases at the Institute for Rubber and Latex Articles, indicated that the main cause of pore formation was water vapour. This particular difficulty was met by including calcium oxide (5-10 parts) in the compound. There was the difficulty of cost of the pure calcium oxide and satisfactory results were in the end obtained by introducing ground lime with the tubing extruded at high temperature.

Several other difficulties were encountered and these will be found described in the article, as will also a figure showing the equipment for the manufacture of extruded rubber articles. This consists of an extruder; a vulcanizer; a cooler; receiving equipment and conveyor belt and steel pipes. Nevertheless, it has not been found possible, or without serious difficulties being encountered, to produce continuously hollow articles.

I cannot give details of all the work carried out by the authors, but it is stated that 800 kilograms of stock were processed in an experiment conducted by the Scientific-Research Institute of the Rubber Industry. The final product was found to conform completely to the specifications of the State Standard. Together with the ' Kauchuk ' works, a ton of rubber prepared by recipe 6008-1 was processed into tubing in a No. 11 rubber mixer.

Amongst the other interesting articles was the manufacturing of hose without using mandrels by L. D. Leitman and A. V. Freiman, and moulds of the closed type by V. V. Pavlov, and method of measuring the thickness of latex balloon envelopes by A. Ya. Gokhshtein and V. N. Provorov.

Notes

An Appeal by Dunlop

The following appears in the October 1959 *Dunlop Gazette,* in the form of an editorial:

' To your Editor, the most exciting news in this issue is the discovery of a Dunlop magazine, *The Hooter,* dated June 10 1910, ante-dating the first issue of the *Dunlop Gazette* by a decade, in which there is mention of a still earlier Dunlop publication dated 1898. This establishes that Dunlop must have been quite early in the magazine field.

' There are few things less interesting than yesterday's news, but, to our mind, few more fascinating than to delve back into what was news a few years ago. Who, for instance, upon finding a copy of a very old newspaper lining some little used cupboard can resist the urge to read it when the time comes to turn out that cupboard, instead of getting on with the job in hand?

' We would, therefore, like to appeal to all Dunlopians who have long family connexions with the company to come forward with any historical information or photographs concerning Dunlop they may have in their private possession. We can then publish in the *Dunlop Gazette* and have the matter on record permanently in the form of the printed page. If people will do this, much interesting information which would otherwise be lost can be preserved.

' The things we do today are mostly routine. We did practically the same yesterday and we shall do much the same tomorrow. They may seem of little interest to us, but how absorbing those everyday details of our doings will be to future generations—that is, so long as we do leave them a permanent record. The proof of this lies in how interesting we find the doings of a past generation.

' The next generation will be interested to know how we, today, did things. Let us not neglect to tell them about ourselves.'

PHILIP SCHIDROWITZ

Questions Corner—97

(Second Series)

407. How is the low temperature brittleness of plastics determined?

408. What is environmental stress cracking of polythene and how may it be determined?

409. What types of synthetic resins may be used for bonding abrasives?

410. For what applications may polyester film be used?

(Answers next week)

Answers to Questions Corner—96

403. One of the most important advantages of polystyrene for packaging applications is that it may be used in direct contact with foodstuffs of all kinds. It is completely inert and imparts no odour or taste to the contents.

Another advantage in the same connexion is that it is inert to moisture and if the contents, *e.g.* salads, are wet they are not harmed, neither will the moisture seep through the container and spoil the contents and possibly adjacent materials.

Polystyrene packages are widely used for frozen foods as they have a wide temperature range within which they may be used.

Recent developments in the production of high impact types of polystyrene have increased the application in other fields where this characteristic is important.

Polystyrene is dimensionally stable and package parts, *e.g.* the top and the bottom, will fit together without subsequent warping.

Finally the clarity of polystyrene is such that not only is it attractive but the contents can be clearly seen, without handling by the potential customer. The use of polystyrene punnets is to be recommended.

404. The following is a brief summary of the ingredients that are normally used in the production of polyester premixes:

1. The resin has to be selected with some care as all polyester resins are not necessarily suitable for these mixes. Two important points should be noted (a) the wetting of the reinforcing material and (b) the flow of the compound under moulding pressure. The volatility of the selected monomer is also important both in respect of the compound during storage and during the actual moulding process. Vinyl toluene may be preferred to styrene.

2. The filler. Several mineral fillers may be used including whiting, china clay, talc, gypsum, etc., which provide a useful base for coloured mixes.

3. Reinforcement. Chopped glass fibre is the most commonly used material but others may be used for specific purposes, *e.g.* asbestos, sisal and so on. Optimum physical properties are obtained with a fibre length of ¼in. and the normal glass fibre content is 5-35% of the mix. Above 20% content the compounds do not flow so easily.

4. The catalyst. A variety of these are commercially available.

5. The pigment content is, of course, a matter of taste and the ultimate end use.

405. Generally, mould temperature influences the following factors in injection moulding: a. Resistance to plastic flow. b. Surface finish. c. Physical properties of the product. d. Length of the moulding cycle.

a. As the temperature of the mould increases in the lower temperature range, the flow is easier and less pressure is required to fill it. On the other hand, as the temperature increases it becomes so much easier to fill the mould that pressure control is very difficult, also the moulding will tend to stick in the mould. Alternatively, if the mould is too cool it will be incompletely filled.

b. Surface blisters can be controlled by mould temperature. Also if the mould is too cold the finish will be matt rather than lustrous.

c. In so far as there may be unwanted strains in the product due to incorrect mould temperature.

d. This follows from (a) above but it should be noted that there is an optimum mould temperature to give the shortest cycle. This is usually determined by trial and error.

406. In the degradation of cellulose automobile lacquers, light, moisture and oxygen are the contributing factors that result in a reduction in the gloss.

The film also becomes gradually thinner due, possibly, to erosion of the vehicle from the surface. This erosion is partly due to the evolution of gases and partly to the removal of water-soluble deterioration products on washing. This, of course, results in the progressive exposure of the pigment particles and a roughened surface results, which scatters the reflected light and is characterized by the loss of gloss.

Cellulose nitrate, in the presence of light, is hydrolysed to cellulose and, at the same time, oxidized to liberate certain gases. This also results in a diminution of gloss.

The nitrogen dioxide evolved in the gases, and the atmospheric oxygen, in the presence of light may oxidize the cellulose to celluronic acid, a deterioration product which has been identified. This acid is also water soluble and the rain will wash this out with further deterioration.

For detailed information see ASTM Bull. 1955 No. 202, 61.

(More questions next week)

IRI Annual Dinner

HANCOCK MEDAL PRESENTED

THE annual dinner of the Institution of the Rubber Industry was held in Birmingham on December 17. More than 170 members attended a most successful event during which Mr George Martin, Chairman of Council, in the unavoidable absence of the President, Sir John Dean, presented the Hancock Medal to Mr J. H. Carrington, B.Sc., F.R.I.C., F.I.R.I. (Anchor Chemical Co. Ltd.). Some excellent speeches were made, including one by Professor Maurice Stacey, F.R.S., who proposed the toast of the IRI.

A full report, with drawings by Fred May, will appear in RUBBER JOURNAL AND INTERNATIONAL PLASTICS for January 2 1960.

Mr L. C. Boos

The death has taken place in New York of Mr L. C. Boos who was a director of the North British Rubber Co. Ltd., US Rubber International (GB) Ltd., the Rubber Regenerating Co. Ltd. and Lastex Yarn and Lactron Thread (Overseas) Ltd. Born in Trinidad, Mr Boos began his career at the age of twenty. In 1941 he became head of the US Rubber Export Co. Ltd., and was made vice-president and general manager of the international division in 1952.

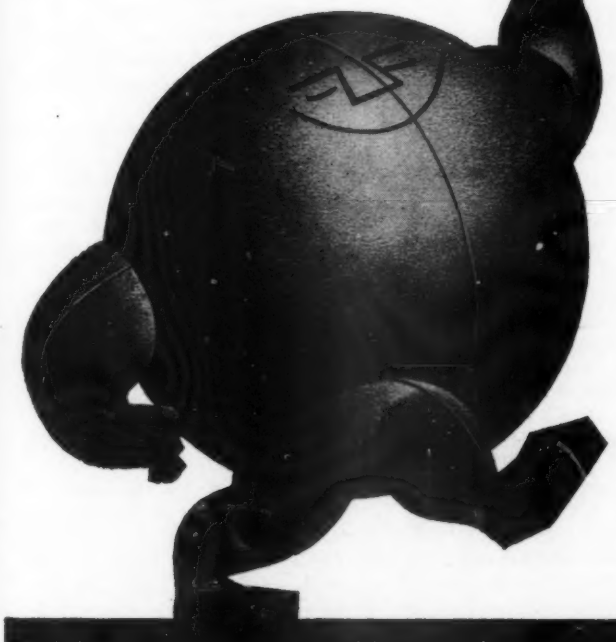
Polly Ester Says . . .

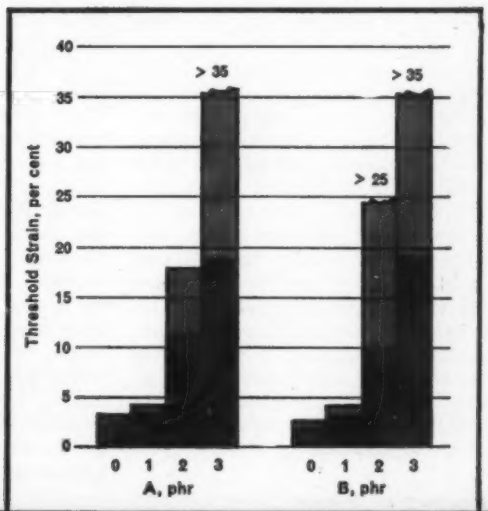
'Cat Crackers — Christmas bon-bons, pets for the use of,'

how can rubber be best protected against SEVERE OZONE CONDITIONS?

UOP 88* ANTIOZONANT

UOP 288* ANTIOZONANT





severe conditions of ozone and stress call for extra-special protection . . .

Smog which may contain up to 100 pphm ozone is hard on health and disposition. It is equally hard on rubber products. High ozone levels cause severe cracking in rubber formulations. In addition, stress also contributes to this problem as shown in chart. How do you prevent such deterioration, assure long service life for your product under severest service conditions?

First, use antiozonants UOP 88 or 288, which offer maximum ozone protection. A relatively small loading of these low-cost antiozonants goes a long way in providing increased protection.

Ozone concentration is but one of many factors to consider in manufacturing antiozonant-containing rubber products. Our staff of specialists, backed by UOP laboratory facilities and field experience, will be happy to discuss your problems with you. Simply write or telephone our Products Department.

40 pphm ozone

120 pphm ozone

Chart above shows effects of increasing antiozonant content of SBR stocks to meet increasing ozone level.

UOP

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

Available in England through Universal-Matthey Products Limited, Stockingswater Lane, Brimsdown, Enfield, Middlesex
Telephone: HOWard 4006,7,8 · Cables and Telegrams: Unimatthey, Enfield · Registered Office: 78 Hatton Garden, London, E.C.1

* *Registered Trademark of the Universal Oil Produce Co,*

MEN and MATTERS

A Review of People and Events

by George A. Greenwood

MR W. J. GARNER, managing director of the P. B. Cow group, has reached retiring age and is to retire as from the end of the year, according to an announcement issued this month by the company. He has held this position for 10 years, and in addition has been chairman of Sorbo Ltd. for more than 25 years, and is a director of several other subsidiary companies in the group. He will also relinquish these directorships.

The group will not, however, completely lose his valuable experience as he will continue in an advisory capacity.

Mr Alexander Shand Baird and Mr Charles Cecil Hawkins will take over his duties as joint managing directors, as from January 1 1960.

Another retirement from the company is that of Mr Charles Hatley who has been with the company for upwards of 30 years and has undertaken the quite invaluable job of what amounts to real customer and public relations. Much of his work, which he has carried out with typical enthusiasm and modesty, has included the all-important and by no means easy task of customer liaison. Also retiring are Robert Alfred Hatcher, development engineer, 65 years old in January 1960, who joined the company in 1934, and Archie Dunbar Parnell, chief buyer, aged 65, who joined the company in 1946.

Honoured by France

From the British headquarters of the Firestone Tyre and Rubber Co. Ltd. comes some interesting information about Mr Harvey S. Firestone, Jun., chairman of the Firestone Tire and Rubber Co. in America, the parent organization. He has been created, by President de Gaulle of France, an Officer in the National Order of the Legion of Honour. The decoration was conferred upon Mr Firestone by His Excellency Herve Alphand, the French Ambassador to the United States, at a special ceremony at the French Embassy in Washington. Mr Firestone was decorated for his work in fostering friendship with the French Republic.

Not long ago I said that Sir Walter Worboys' retirement from I.C.I. had not to be taken as implying his withdrawal from public life. And I was right! Because, presumably of his post in the Federation of British Industries, he has been chosen as one of the 14 men and women who are to make up the personnel of the Export Publicity Council, which is to operate under the Board of Trade with Mr F. J. Erroll, Minister of State at the Board, in the chair. With him, among the others, is Mr N. Jepson, well-known in rubber and chemicals for his connexion with the National Union of Manufacturers.

More Dunlop Changes

It is a sign of increasing years when you hear that a man is retiring after 32 of 'em in one job, and you yourself have known him, or of him, throughout the whole of the period. The individual in this case is Mr John Bonar MacColl, Information Officer and Publicity Manager at the Dunlop Rubber Co., who retires at the end of the year. Altogether, he has been with the organization for 32 years, and it must have been about the time of his joining it that I first heard of him from the company's famous Press liaison, my old friend Mr Robert Williamson. They had, as you will gather, more than a Scottish origin to bind them!

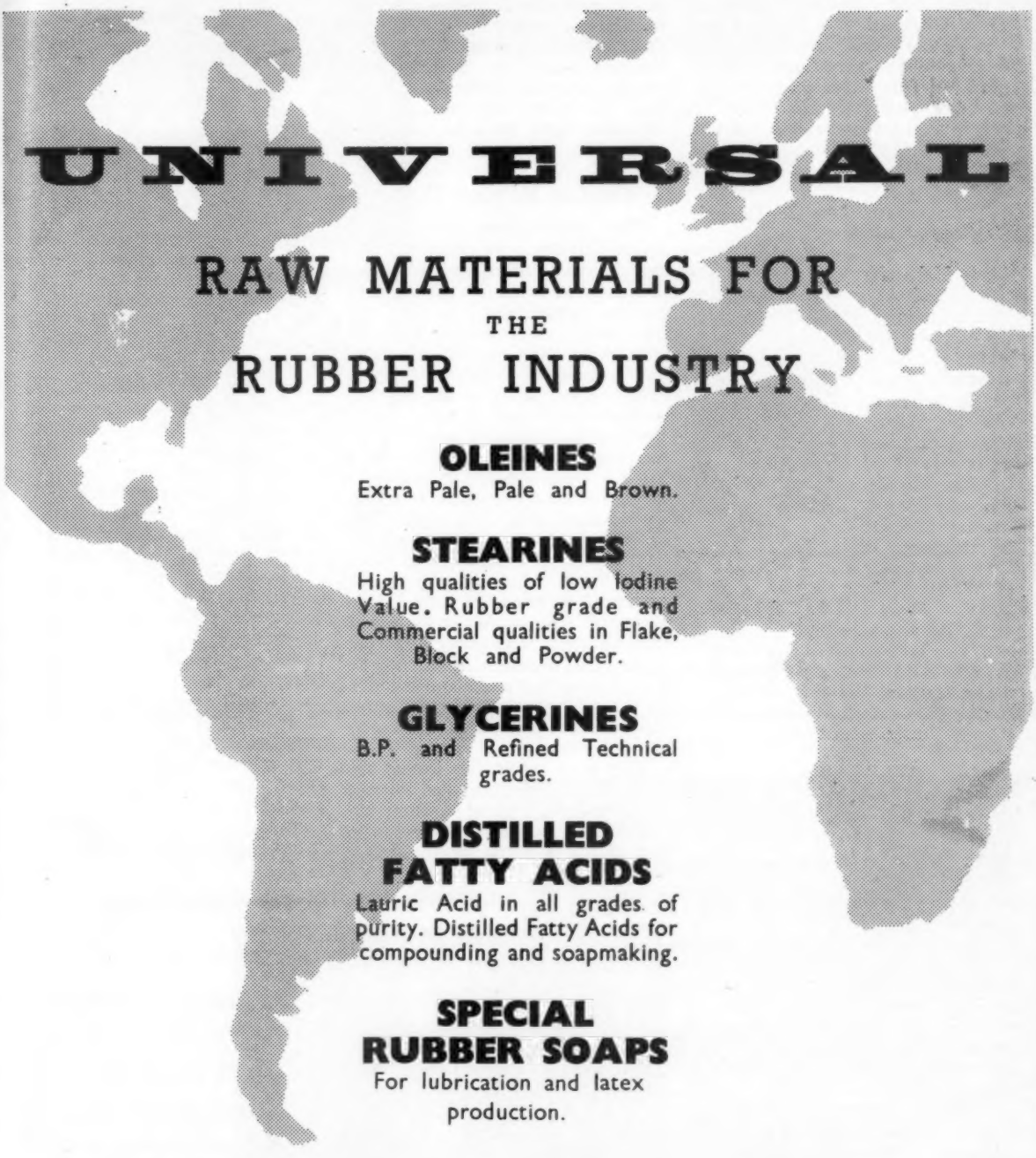
Born in Glasgow 60 years ago, Mr MacColl attended Glasgow's Royal Technical College and was apprenticed to Barclay, Curle and Co. Ltd., the Clydeside engineers and shipbuilders, going on from there to the marine engine drawing and design offices of William Beardmore and Co. Ltd., at Dalmuir. Then he gave up engineering for the publishing and publicity departments of William Collins, Sons and Co. Ltd., and in 1927 was appointed advertising assistant and technical writer at Fort Dunlop. Three years later, he transferred to Dunlop's London headquarters in charge of the tyre group's Press advertising.

After an interval during the war on material control with the Aviation Division in Coventry, he returned to London to do internal works propaganda for the war effort. Mr MacColl is a member of the Institute of Public Relations, and, when these were functioning he was also a member of the Public Relations Committee of the Federation of British Industries and of the Public Relations Advisory Panel of the Society of Motor Manufacturers and Traders.

CAPability

I was amused by the comment accompanying details of the tube caps manufactured by the Plastics Division of Universal Metal Products Ltd. (U.M.P.) of Salford, Lancs., by com-

Caps manufactured by the Plastics Division of Universal Metal Products Ltd. referred to in the text



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pression and injection moulding. These include new type flowerpot caps (see picture) which are made from thermosetting materials such as wood-filled and paper-filled urea, and also in thermoplastic materials such as polythene. Incidentally, I am told that all U.M.P. polythene caps are destaticized before being placed on the tubes.

The comment? 'Another Example of U.M.P. CAPability.'

Akron University

F. J. BEUCHE

Dr Fredrick J. Beuche has joined the University of Akron staff as a Research Associate in the Institute for Rubber Research and Professor of Polymer Physics. His appointment became effective on December 1. Dr Beuche comes from the University of Wyoming where he was a Professor of Physics since 1953. Prior to that he was associated with Rohm and Haas in Philadelphia as a research physicist. He received his Bachelor's degree from the University of Michigan in 1944 and his Doctorate from Cornell University in 1948.

Shell Chemicals

From a friend I hear that the Shell Chemical reorganization scheme, which obviously reflects the growth of the market for its industrial products, is now well under way. The scheme has become effective. The industrial Chemicals Division, of which the manager is Mr P. J. March, is dealing with solvents, general chemicals, resins and detergent products. The Plastics Division, with Mr V. N. Luke as manager, has responsibility for polyolefins, polystyrene, polyvinyl chloride and synthetic rubber.

There are one or two other purely personal announcements. Mr C. C. Hallett, managing director of Witco Chemical Company of London, has been elected to the main Board by the parent company, Witco Chemical Company Inc., of New York. Mr R. Shacklady, joint managing director in London, has been nominated his alternative on the American Board.

Christmas Cards

Vinyl Products Ltd. and Vinatex Ltd., Carshalton, Surrey, inform me that they have joined the ever-increasing ranks of those companies who have discontinued the practice of circulating expensive Christmas cards to their friends. They are this year sending out a very simple version and are donating the money saved thereby to charity. As reported in *RJIP* (which has also decided to discontinue the practice) last week, Monsanto Chemicals Ltd. have this year cut out Christmas cards altogether in favour of donating a large sum to the needy.

Ceylon Export Duty

The recent controversy concerning the legality of the recent increases in the Ceylon rubber export duty has been referred to the Attorney-General and no further rubber auctions will take place in Colombo until the position has been clarified, the principal collector of customs has told the Press. The validity of the increases has been challenged by the Ceylon Chamber of Commerce, which claims that since the sanction of Parliament has not been obtained it would be illegal for the Government to collect the enhanced duty. The export duty on rubber stood at 20 cents per lb. until September 9 when it was raised to 28 cents. Subsequently it was raised still further to 38 cents. However, the Finance Minister's orders making these increases were not ratified by Parliament, as required by law, before Parliament's dissolution on December 5. In view of this the rubber trade claims that the orders are now void.

The latest report has it that the Government will keep the increase in force by collecting it from exporters as licence fees rather than as part of export duty. This move requires no Parliamentary sanction.

New Research Laboratories

J. AND E. STURGE £100,000 PROGRAMME

NEW laboratories for organic and biochemical research work have been opened at Wheeleys Road, Birmingham, by John and E. Sturge Ltd., as part of an overall plan to centralize the company's research work. The existing physical chemistry research laboratories at Wheeleys Road have been modernized, and are now fully equipped for radiochemical and high vacuum work and for ultra violet spectroscopy.

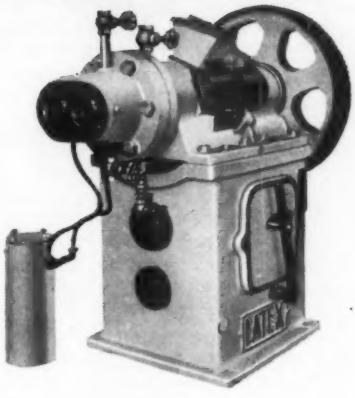
At the company's Lifford Chemical Works, Birmingham, the analytical laboratories are being extended to cope with the testing of increased production, and the development laboratories have been rehoused in larger premises and now include a section for technical service work on rubber, plastics, paper, paint and printing inks.

The Yorkshire laboratories at the company's Selby works — formerly devoted to the organic and biochemical research work—are now being used to extend the facilities of the development, analytical and microbiological departments. Construction work will start shortly on a new fully-equipped pilot plant, together with an associated laboratory and administrative offices.

The entire programme, which will be completed by the end of 1960, will cost over £100,000.

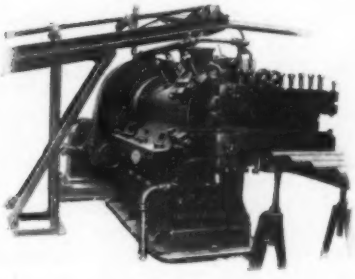
Fablon polythene film solved the hot-upstairs-cold-downstairs problem of a 'Do-It-Yourself' shop in Norwich. The 150-gauge film was fastened to the walls and supported on wires across the open shop area

Latex Engineering Co



Forcing Machine with Twin Nozzles for Cycle Tubes

8" Forcing Machine fitted with "Camel-Back" Dies driven by variable speed A.C. Motor equipped with Feed and Output Conveyors



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Patent Caoutchouc Case of 1836

NEW LIGHT ON THE EARLY HISTORY OF THE BRITISH RUBBER INDUSTRY

(Concluded from December 19 issue, page 802)

By H. SCHURER, Ph.D., F.I.A.

THE survey closed with outlining a sombre picture of the fate of the inventor in early nineteenth century Britain 'When his [the inventor's H.S.] plans are fully before the world and incredulity can no longer deny his success nor ignorance itself mistake it, immoving prejudice stands across his path and forbids him his reward. His trials, however, have taught him to triumph by perseverance; public opinion pronounces his title to recompense when some foul, lurking, perhaps wealthy plagiarist, shrinking from no villainy if it be but gainful seizes on some quirk of law, robs him of his right and employs his scoundrel purse to defend the rank iniquity.'[15]

Should any reader have been too slow-witted to see the all union to Macintosh-Hancock and Wynne Ellis, the concluding sentence would have made the meaning abundantly clear to the most innocent: 'Such is too often the history of inventions and inventors. We have been reminded of some of its features by the enquiries recent and unexpected events have induced us to make into the progress of the manufacture of caoutchouc.' This was an unmistakable allusion to the success of Everington and Ellis in having Macintosh's injunction dissolved in December 1835.

The 'Mechanics' Magazine' obviously reckoned with the likelihood of a defeat for Macintosh and Hancock. 'If public legal justice could always follow the line of actual justice there can be as little doubt that the pending trial would confirm the legal rights of Messrs Macintosh and Hancock. It is not for us to guess by what shuffle of law or quirk of dexterity substantial justice may be defeated if it be defeated; but we shall watch the proceedings with interest, for we look for much curious information as well as for singular illustrations of the present miserable state of the law of patents.'[16]

Scientists Defend Macintosh's Claim

That was clear and strong language, though the issues at stake could not just be presented in terms of the nursery as black against white, as good fighting evil. The situation was a little more complex than that. The Attorney General, Sir John Campbell (acting for the plaintiffs) in a forceful speech compared the fame of Macintosh's patent to the celebrity of Boulton and Watts' and of Arkwright's historic patents. He stressed its complete originality and made it clear that Macintosh did not claim the solution, but the double texture principle in combination with the solution. As the defence had accused the specification of being vague on the point of the solvent proposed, a great deal of evidence was presented by the plaintiffs to show that 'coal oil' referred to in the 1823 specification was a substance well known in chemistry and that a rubber solution in 'coal oil' was effective in producing a waterproof double texture. The witnesses, mostly prominent scientists, were unanimous on that point, and agreed that the invention was new in 1823 and had caused great interest in scientific circles at the time.

Reveal—or Not Reveal

Up till then the evidence made an impressive show for the plaintiffs. When it came to witnesses from the actual workshops they found themselves on much more delicate ground. They could not very well do without such witnesses who would have to testify to what extent the manufacture followed the patent of 1823 — on the other hand they did not want to disclose details concerning the masticator, the utilization of masticated rubber in the solution, and the actual composition of the solution. Macintosh, up to 1830, appears to have used coal tar naphtha, purified by distillation; Hancock, in addition to using masticated rubber, preferred a mix of the naphtha solution with turpentine, but what the composition used after 1830 actually was, in addition to the basic ingredients, remains unknown. Apart from these features of the manufacture Macintosh and Hancock were not overanxious to disclose details of the spreading machinery. All these new features had been superimposed on the original simple process of 1823 owing to Hancock's joining—and, according to the defence, with them had come the profitability of the business which did not exist in the pre-Hancock period.

Hancock felt that at any costs revelations concerning the masticator must be avoided. As some disclosures seemed inevitable the choice before them was between the masticator and the solution making on the one hand and the spreading process on the other. Macintosh and Hancock chose to risk some revelations concerning the spreading machinery rather than to take any chance with the masticator. Thus the witness who was put forward as the best source of information on the whole manufacture was a man who had been works manager of the whole waterproofing in Glasgow up to 1825, but had left Macintosh's service when the business moved to Manchester. He only knew the first primitive phase of the manufacture. Even allowing for the fact that the events referred to went back about ten years this man's answers were of extreme vagueness. He confirmed in this time the process had been carried out according to the specification of 1823. His knowledge stopped with 1825.

The Spreading Process

A much more delicate situation arose when the plaintiffs produced as their witness the man in charge of the spreading at the actual time of the trial. He could faithfully deny any knowledge whatever as to how the solution was made up. That was kept secret and he knew nothing about it. The 'Mechanics' Magazine,' always anxious to keep Hancock's interests in mind, interrupts its account of this man's evidence and states expressly that large chunks of the evidence have been omitted as they present disclosures of facts not intended for publication. The manuscript report thus remains the only source available for a sketch of the gradual development of the spreading machinery elicited by the Counsel for the defence from the witness. That makes it particularly interesting to anybody concerned with the hisof rubber machinery.

At first, as the manuscript report tells us, the solution was put on by hand with a brush, in the Glasgow phase, then after 1825, in Manchester the cloth was passed through one

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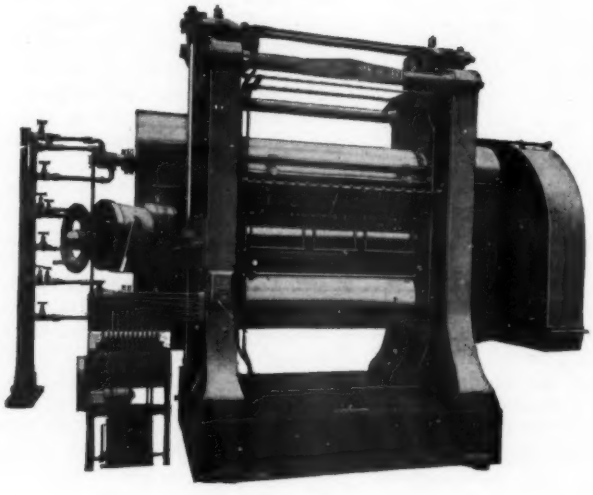

24" dia. x 68" face 3-ROLL EVEN and FRICTION SPEED RUBBER CALENDER, with Patent Nip Feed Guard, Circular Lubricating System from individually driven 12-point Forced Feed Lubricator with Self Filling Pumps. Mechanically Operated Elevating Unit for top and bottom Rolls. Variable Speed Drive to suit any requirement.

The ANALYSIS of RUBBER AND RUBBER-LIKE POLYMERS

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R.A.B.R.M. MANUAL No. 3

By WILLIAM C. WAKE
M.Sc., Ph.D.(Lond.), F.R.I.C., F.I.R.I.
HEAD of CHEMISTRY DIVISION
RESEARCH ASSOCIATION of BRITISH RUBBER MANUFACTURERS

THE first modern work devoted solely to this important subject to be published in the English language. In addition to the analysis of natural and synthetic rubbers, the author deals with rubber-like plastics such as Polyethylene, PVC, PVDC, PVA and Urethanes. Also discussed are the identification of compounding ingredients used in the manufacture of rubber and rubber-like polymers.

It will unquestionably become a standard work and is a "must" for all analysts interested in this subject.

CONTENTS:

Extraction Procedures - Qualitative Analysis for Polymer Type - Elemental Analysis of Extracted Polymer - Direct Determination by Functional Group Analysis - Solution and Dissolution Methods - Quantitative Cracking and Distillation Methods - Carbon Black in Rubber - Ashing, Wet and Dry, and the Determination of Trace Metals - Analysis of Extracts and Blooms - Statistical Aspects of Analytical Work.

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roller to another which had the solution on it. The solution was applied to the roller from a small trough or cistern. Then the solution was spread by a brush. Gradually, in a later refinement of the process, a number of brushes driven by power were used. After the cloth had passed the rollers, there were these brushes in front of the cloth having a traverse motion which caught the cloth the moment it left the roller and brushed the cloth over. From 8 to 12 small spiral brushes, worked by power, were used. After the cloth had left the brushes another roller was used to smooth the cloth down.

This spreading machinery was used three or four months after the move to Manchester, *i.e.* in 1825. The cloth had to pass what the witness called 'the bar,' then it passed over some small steam chests about nine foot in diameter and over a large steam cylinder. The chests were stationary, the cylinder revolved. Within about 12 months from Hancock establishing closer relations with the Macintosh firm in 1830 the solution began being made in Manchester, no longer in Glasgow—as we know, according to Hancock's secret method. Of the details, the witness knew nothing.

No leakage concerning the masticator originated from the witnesses for the plaintiffs, nor was it likely that the defence would be in a position to produce witnesses with relevant information, under the circumstances. The witness admitted that since Hancock's appearance on the Manchester scene great changes had taken place in the spreading machinery. Instead of several steam boxes only one was now being used. The old 'bar' had been replaced by a new piece of machinery referred to as a 'gauge' by the witness. That was a verbed reference to the spreading machine developed by Hancock, the prototpye of the modern machine.

At this moment the Attorney General rose — 'at last,' as the 'Mechanics' Magazine' puts it acidly, implying that he had been somewhat slow in seeing the implications of the 'fishing' questions of the defence, and strongly protested. The further questioning of the witness concerning the latest developments was stopped after this intervention as it appeared irrelevant to the point at issue. The witness did not think, as the defence suggested that business had improved immediately Hancock appeared, but he agreed it had become more profitable within the last two years.

Macintosh's or Hancock's Process?

The defence made great play of the dispute concerning patent infringement which had brought Hancock into conflict with Macintosh in 1825—details which cannot be found in the 'Mechanics' Magazine.' All references to that episode were passed over in discreet silence. The defence tried to establish that the profitability of the process was based entirely on the accretions to it, resultant from the appearance of Hancock with his secret processes. Their counsel held out a piece of stuff proofed with naphtha solution, demanded dramatically, 'Put your nose to it,' and then held out a piece marketed by the defendants and allegedly originating from the mysterious Fanshawe, and asked what had these two pieces in common? Could the nasty malodorous piece offer any serious competition to the beautiful Fanshawe sample? A specification which did not say in what way this remarkable product was achieved in actual manufacture was like a performance of 'Hamlet' without the Prince of Denmark. The careful selection of the witnesses by the plaintiffs had not escaped the defence either, needless to say.

Charles Green's Balloons

The defence produced a formidable witness in the person of the famous aeronaut Charles Green. He declared he had employed the double texture principle for the construction of his balloons, miniature balloons as well as large ones, for about 25 years. Under searching questioning he had to admit, however, that the rubber/turpentine solution used had been mixed with gum mastic, and that the mix had been purely used as a cement, not for rendering the balloon fabric gas impermeable. His son and a collaborator had to admit that the process had been freely disclosed and had been known by the time Macintosh's patent was taken out in 1823. Green had certainly hit on an original idea by uniting the segments of his balloons by cement only. He caused considerable amusement by making fun of the claims put forward by the array of academics who had come forward as witnesses for the plaintiffs. When he, Green, for the first time used coal gas for a balloon, the men of science had all prophesied disaster. 'In proportion as he mounted up their opinions went down!'

The Coats of Demerara

The other witness for the defence, a physician, by an odd coincidence called Hancock, was less impressive. He testified that waterproof materials had been used in Demerara at the beginning of the century, that the two-ply principle had been employed in their construction, and that rubber latex had been utilized as the waterproofing agent. What had been done in Demerara with latex obtained on the spot, clearly had little relevance to what had been achieved in Glasgow with the by-products of the gasworks.

Not a single scientist could be marshalled by the defence to speak against Macintosh's claim. Their counsel had to fall back on belittling the value of the evidence of the men of science. Had they not testified, in a murder case, that a spoon had changed its colour owing to the action of arsenic —and had it not been proved that the discoloration had really been due to an onion?

In a final speech the Attorney General, for the plaintiffs, dismissed the attempts of the defence to drag in the 1825 dispute between Macintosh and Hancock as irrelevant. He stressed the undoubted originality of Macintosh's specification of 1823. He demonstrated that in the light of the information obtained by questioning Charles Green and his associates' anticipation of Macintosh's proposal by Green could not be established. The Lord Chief Justice began his summing-up, but was interrupted by the foreman of the special jury who signified they had made up their minds. The verdict was given in favour of the plaintiffs. Macintosh and Hancock had scored a great victory. Their ally, the 'Mechanics' Magazine' was triumphant. In March 1936 the Vice-Chancellor granted an injunction against further infringement of the 1823 patent.

The Petition for Renewal Fails in 1837

The sequel, however, was not quite so happy as Hancock's 'Narrative' and George Macintosh's 'Memoir' would lead the reader to assume. It will be remembered that parallel with the campaign against patent infringement went the petition for a renewal of the patent. In February 1837 Macintosh applied for the date of a new hearing to be fixed after his original petition of January 1836 had been held over. Opposition against the renewal proved so powerful, however, that within the next few months, Macintosh thought it wiser to abandon the petition. In June 1837, costs were granted to one of the opposing parties for expenses occasioned by their opposition to the renewal of the patent. All this amounted to a clear setback for Macintosh and Hancock.[17]

Hancock Discloses the Masticator

They were left without legal protection of their manufacture. There

were competitors possessed of the knowledge of the process, and equipped with technical and financial resources to set up a rival manufacture. Under the circumstances, quick action seemed necessary. After keeping the secret, as far as had been in his power, since 1820, Hancock, at this critical moment, decided to save what could be saved in a confused situation, put forward a patent application covering both the masticator and the spreading machinery in April 1837 and obtained a patent for the process at the end of the year.

The situation created by the failure of their petition had forced him into the open with his inventions. It was not that he invented a spreading machine in 1837 and took out a patent for it, but that he was forced to disclose a spreading machine used for several years and was driven to this step by the whip of necessity.

The timing of the patent application—April 1837—is significant and reveals how closely the abandoning of the petition for the renewal of the 1823 patent and the application for the masticator and spreading machine patent were linked. It was a counter move in a campaign where after the success of 1836 there had been a defeat in 1837.

Help from Switzerland

As the fact is not mentioned by Hancock and George Macintosh, it may be said that in the same year 1837 by a great piece of luck the Birley brothers managed to secure the services of one of the most able mechanical minds of the time, of the Swiss Johann Georg Bodmer, who was called to Lancashire to design textile machinery for them. He gave his mind to the problem of machinery for rubber processing as well and obviously proved a very valuable asset to the Macintosh concern. Without going into details it may suffice to quote the words of the obituary: 'Mr Bodmer made the plans and drawings for and executed at his works a whole series of machinery for the preparation of caoutchouc to the orders of Messrs Macintosh and Co.'[16]

Without looking at the past through romantic spectacles, it may be permitted to see in the great fire in the Macintosh works of 1838 some sort of symbolic close of one phase of the history of rubber—of the pre-vulcanization phase. It has been attempted to show that the early years of the British rubber industry were beset by greater difficulties, personal clashes, and setbacks than would meet the eye of the reader of Hancock's and George Macintosh's accounts. That should make this initial phase not less interesting.

Macintosh and Hancock had laid the foundations for an industry that was to expand and grow more important as the years went by. When, at the time of the Great Exhibition of 1851, in a series of lectures on the new industrial age delivered to the Society of Arts, Manufactures and Commerce (the Royal Society of Arts of today), Professor Edward Solly devoted a few remarks to rubber he could state with conviction: 'A century ago caoutchouc or india-rubber was only known as a curiosity—now it is regarded almost as a necessity of life.'[19] The decades to follow have done their best to wipe out the professor's qualifying 'almost.'

APPENDIX

Specification of the Patent granted to Charles Macintosh, of Cross Basket, Lanark, Scotland, Esq., for a Process and Manufacture whereby the Texture of Hemp, Flax, Wool, Cotton, and Silk, and also Leather, Paper and other Substances, may be rendered impervious to Water and Air. Dated June 17, 1823.

. . . My said invention doth consist in a manufacture of two or more pieces of linen, woollen, cotton, silk, leather, or paper, or other the like substances, any or either, or combinations of any or either, the same cemented together by means of a flexible cement, the nature of which said manufacture is, that it is impervious to water and air. . . . I prepare caoutchouc by cutting it into thin shreds or parings, and then steep it in the substance which is produced in making coal gas, commonly called coal-oil. . . . When the caoutchouc is of the best quality, and the oil pure, from 10 to 12 oz. of the former to a wine-gallon of the latter will be found to answer. This infusion I submit to a gentle heat obtained from a water or steam bath, and I employ constant trituration, until such time as the ingredients are reduced to a thin pulpy mass, when, to render the whole as homogeneous as possible, I pass it through a very fine wire or silk sieve . . . the varnish will then be without any granular particles and will in appearance resemble thin transparent honey. Fabrics or substances, effectually united by cement thus prepared . . . become both air and water-proof; but, with a view to prevent the cement from appearing on the surface . . . and to ensure . . . a perfect unison of the substances, I . . . distend the substances to be united, and, with a brush, or other suitable instrument, lay upon the surface of each a uniform layer . . . of the . . . cement; and, when this coating has, from evaporation of the oil, which is extremely volatile, acquired a clammy viscous consistency . . . I apply the varnished side of both substances to each other, and by means of a calender or rollers . . . I powerfully press the fabrics or substances together, whereby they become united, and are rendered a compound fabric or substance. . . . I expose this compound fabric . . . to a heat of from 100 to 140 degrees, for the double purpose of maturing the manufacture, and obtaining a further evaporation of the oil, which, while it remains, gives off a disagreeable effluvium. . . .

In some cases it may be sufficient to apply the layer . . . of the varnish upon one side only of one of the fabrics . . . applying the other fabric . . . uncoated upon the clammy viscous surface of that which has received one or more coatings of the varnish. . . . Whereas caoutchouc in a state of solution, and dissolved in manner hereinbefore described, is well known to chemists . . . and not new, therefore, I do not claim any right, title or privilege in respect to the same; but a manufacture of two or more pieces of linen, woollen, cotton, silk, leather, or paper, or other the like substances, any or either, or any combinations of any or either, the same cemented together by means of flexible cement in manner hereinbefore described, being . . . entirely new, and never before used in these Kingdoms. . . .

(*Repertory of Arts*, 1825, **46**, Second Series, pp. 199-201.)

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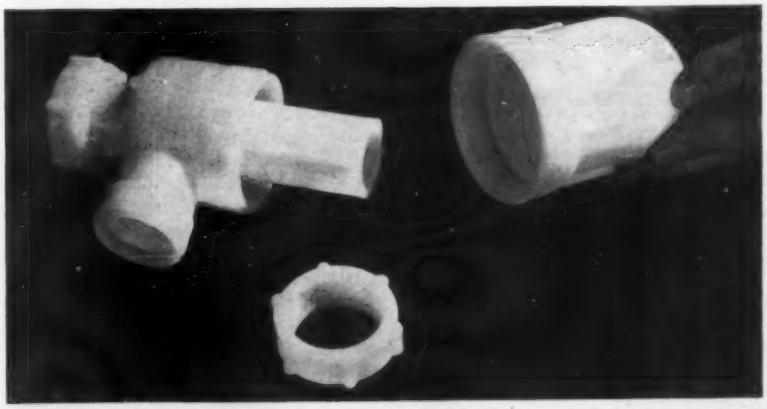

Waste traps which resist both frost and boiling water are now being produced by McAlpine and Co. Ltd., Kelvin Avenue, Hillington, Glasgow, S.W.2. These bottle traps, which are moulded in 'Rigidex' high-density polythene supplied by British Resin Products Ltd., are suitable for all types of waste pipes, and provide a 3-in. water seal

INTERNATIONAL RUBBER CONFERENCE

Continued from page 838

tin methacrylate) and a copolymer of tri- and di-butyltin methacrylate. It will be immediatedly appreciated that the tin atom is not in the main chain of the polymer. These polymers were cross-linked by sulphur in the presence of dibutyltin oxide and dibutyltin dihydride. Since the main structure depends on the stability of carbon-carbon bonds one would not expect very exceptional high temperature properties although, undoubtedly they will be self-extinguishing when ignited.

Conclusions

It is obvious from the papers at the Conference that the centre of scientific interest is no longer the kinetic theory of elasticity and the working out in detail of the way network structures can lead to this or that property. Much is already known and is now accepted whilst the problem of ultimate strength, which seems to depend so much on secondary forces as well as the network, has scarcely been tackled. Rather, people are turning to the phenomena of tear and abrasion and this conference has taken place at a time when considerable clarification of wear properties is possible, and useful application to tyre behaviour can be made. The group of papers dealing with these things are probably among those of most permanent value from this conference. Chemistry, seems to me, to have taken second place in spite of the valuable papers which do much to clarify our ideas of cross-linking in sulphur and in peroxide vulcanizates.

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[12]A. Schallamach, *The Role of Hysteresis in Tyre Wear and Laboratory Abrasion*, Proc. p. 142.
[13]H. H. Vickers and S. B. Robison, *Measurement of Tread Motions and Application to Tyre Performance*, Proc. p. 128.
[14]F. W. Boggs, *A Theory of Rubber Abrasion*, Proc. p. 149.
[15]L. Mullins, *Reinforcement of Rubber by Fillers, Tear Resistance*, Proc. p. 389.
[16]J. P. Berry, P. J. Cayre and M. Morton, *Elastomer-Filler Interactions*, Proc. p. 396.
[17]J. R. Shelton and E. T. McDonel, *Investigation of Radical and Polar Mechanisms in Vulcanization Reactions*, Proc. p. 596.
[18]H. L. Pederson, *Estimation of States of Cure Using S-35*, Proc. p. 555.
[19]L. O. Amberg and W. D. Willis, *Chemical Interpretation of Dicumyl Peroxide Vulcanization*, Proc. p. 565.
[20]J. F. Smith, *The Chemistry of Vulzanization of Viton A Fluorocarbon Elastomer*, Proc. p. 575.
[21]J. I. Cuneen, *Cis-Trans Isomerization in Natural Polyisoprenes*, Proc. p. 514.
[22]A. Nersasian and D. E. Anderson, *The Structure of Chlorosulphonated Polythene*, Proc. p. 537.
[23]G. Salomon, C. Koningsberger and A. J. Ultee, *Proc. Rubber Tech. Conf.*, 1948, Inst. Rubber Ind., London, p. 106.
[24]J. C. Montermoso, T. M. Andrews, L. P. Marinelli and B. R. La Liberte, *Synthesis and Properties of Organotin Elastomers*, Proc. p. 526.

NATURAL AND SYNTHETIC RUBBER

Continued from page 846

low-grade rubber. Three questions therefore arose. If tyre manufacturers would only buy low grades of rubber and not even the cleanest at present available, what useful purpose was served by the rubber producers trying to make better, and in particular cleaner, rubber? If buyers would not pay the price even for first-grade unmodified rubber, what was the point of developing special types for which a premium would have to be asked? Finally—and perhaps this question should have come first—was the BBC report true?

Dr Bateman said the US stockpile consisted of about 50,000 tons. Of this 35,000 tons was No. 1 smoked sheet, but it had been in stock since about 1940 and the rubber manufacturers did not wish to pay the present market price for this old rubber. Certainly some manufacturers could use the lower grades. The practice differed in different countries. In general, large users were better able to use the low grades. Modification of natural rubber to produce entirely different materials was economically out of the question, but to prepare a rubber which would be more efficient could justify a premium. Mr Davis said we would have been saved a lot of headaches if only one grade of rubber were produced. However, age was no bar to the use of rubber and material 20 or 30 years old was perfectly satisfactory. It was, however, almost always frozen after this time, but when suitably thawed—and this process may be a nuisance—it was perfectly satisfactory.

Oil-Extended NR

Dr F. H. Cotton asked what attempts had the natural rubber producers made to obtain an oil-extended natural rubber.

Dr Bateman outlined two lines of work. In the factory it had been shown by the Rubber Stichting that up to 15 parts of oil could be used in black mixes without detriment, but this admittedly, was less than the 30 or 40 parts of oil used with SBR. Attempts had been made on the plantations to harden natural rubber and then soften it by oil. The mix had, however, to contain carbon black and this meant that it was liable to an increased import duty in many countries. The SBR rubber used for oil extension was a polymer of high molecular weight, and it was not possible to control the molecular weight of natural rubber. Work was still uneconomical, however, with hardening methods. Mr Kellett said manufacturers were adding 15 parts or more of oil. Adding this on the plantation would mean that the oil would have to stand freight charges.

Other questions concerned problems of tyre manufacture with butyl, including adhesion. The new Pirelli interchangeable tread design might prove very satisfactory in this particular rubber. Butyl production had increased but there was some shortage and one questioner drew attention to this and to the stable price of butyl.

Mr Mullins gave a short vote of thanks in which he recalled that it was more than 10 years since the London Section had held a meeting of this kind. He paid tribute to the work of the organizing sub-committee and suggested that the obvious success of the evening might lead to repeat performances on other controversial topics in the future programmes of the section. Finally, in thanking the speakers, he drew from the members a hearty round of applause.

Mr J. Christopher Ingram has accepted an invitation to join the board of Redfern Holdings on December 1. He will also be assistant managing director of Redfern's Rubber Works. Mr R. N. D. Langdon has been appointed a director of Wm. Finlay (Belfast).

Book Reviews

INTERNATIONAL SYMPOSIUM ON PLASTICS TESTING AND STANDARDIZATION —STP 247. (American Society for Testing Materials, pp. 276, hard cover, 6in. x 9in.)

This symposium presents four general topics. The first deals with 'How National Standards are Achieved.' Twelve nations are represented in this section. The second part is 'Engineering Properties of Plastics' containing six papers. 'Thermal Properties of Plastics' with four papers forms the third part; and 'Molecular Characterization' with four papers concludes the symposium. Plastics engineers and technologists will find this extensive symposium of keen interest treating as it does such a wide scope of activity.

Sponsored by the American Society for Testing Materials in October 1958, in Philadelphia, this symposium was arranged to co-ordinate with the Eighth Annual Meeting of Technical Committee 61—Plastics, of the International Organization for Standardization which was held in November 1958, Washington, D.C.

The session on 'How National Standards are Achieved' accomplished the very significant objective of presenting, following a standard outline, the 1958 national standardization story for each of twelve nations. This background will be most helpful in future work on plastics and, more broadly, in all international standardization. The sessions on engineering properties and on thermal properties of plastics dealt with techniques applicable to the standardization work of today and the near future. The papers in these sessions were important not only as they presented information on the ever advancing technology, but as they foster understanding of the technical base on which the national standards of the world are built. The final session on methods for molecular characterization pointed the way to standardization technology of the future.

The contents are: Introduction, by George F. Hussey, Jr; Standardization in Belgium, Czechoslovakia, France, Germany, Hungary, the Netherlands, Poland, Rumania, Sweden, United Kingdom, USA, USSR; Summary, by Robert J. Painter; Fundamentals of the Mechanical Properties of Plastics, by B. Bossu, M. Chatain, P. Dubois and J. Rougeaux; Anisotropic Effects in Testing Plastics, by Hilding Hogberg; On the Most Suitable Specimen Shape for Testing Shear Strength of Plastics, by Niuma Goldenberg, Mircea Arcan and Edward Nicolau; Encyclopaedia of Electrical Insulating Materials, by G. de Senarclens; Mechanical Properties of Plastics at High Speeds of Stressing, by H. Warburton Hall; An Improved Flow Tester for Thermosetting and Thermoplastic Moulding Compounds, by C. M. von Meysenbug; The Vicat Softening Point Test Method: Correlations, Uses and Variants, by C. E. Stephenson and A. H. Willbourn; Rheology of Polymer Melts—A Correlation of Dynamic and Steady Flow Measurements, by W. P. Cox and E. H. Merz; Transition Phenomena in the Study of Impact Strength of Plastics, by Michel Juillard; The Accurate Determination of Molecular Weights of Macromolecules, by Donald McIntyre; The Use of Infra-red Spectroscopy in Characterization of Polymer Structure, by W. J. Potts; The Use of X-ray Diffraction and Scattering in Characterization of Polymer Structure, by W. O. Statton; Nuclear Resonance Studies of Polymer Chain Flexibility, by W. P. Slichter.

CABMA REGISTER OF BRITISH INDUSTRIAL PRODUCTS FOR CANADA 1959-60. (London: Kelly's Directories Ltd. and Iliffe and Son Ltd. for the Canadian Association of British Manufacturers and Agencies. 7th edn., pp. 653, 15s. post free.)

This reference book has been published annually since 1953 for CABMA, whose object is to stimulate the two-way flow of trade between Canada and the UK. This edition has been completely revised, and the Buyers' Guide lists 3,000 UK products available for the Canadian market, with their suppliers. Most aspects of the rubber and plastics industries are well covered. There are other sections on proprietary names, trade marks, and a helpful French glossary relating to the Buyers' Guide.

Tinted paper and a slotted index make the register easy to use, and it is an essential work of reference for the Canadian buyer.

∴ Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

Vulcan Patents

Vulcan Equipment Co. Ltd. have recently obtained patents relating to their Mandrel Air Pressure system invention, both in Canada and the United States. United States Patent No. 2,904,842, became effective on September 22 1959; Canadian Patent No. 587,880, was granted on December 1 1959. With other patents pending in Canada, United States and foreign countries, Vulcan state that their intention is to enforce all rights inherent in such protection.

The Northern office of W. Harrison and Co. Ltd. has been moved to 70 The Albany, Liverpool, 3 (telephone: Liverpool Central 4227). The old office was at 56 Mosley Street, Manchester.

Rubber Crop Returns

Unless otherwise indicated the figures quoted, to the nearest thousand lb., represent crop returns for the month stated and for the number of months of the planting company's financial year to date. Corresponding figures are given in parentheses.

RUBBER ESTATE AGENCY

November

Bandar Sumatra.—109 (135). 4 mths—400 (417).
Batu Kawan.—73 (56). 3 mths—207 (183).
Buntar.—123 (97). 17 mths—1,805 (1,536).
Eastern Sumatra.—377 (424). 9 mths—2,963 (3,009).
Amalgamated Rubber.—33 (35). 11 mths—340 (353).
Java Rubber Plants.—68 (75). 11 mths—803 (853).
Jeram.—329 (210). 2 mths—648 (432).
Kepitigalla.—58 (56). 8 mths—435 (452).
Kuala Lumpur.—700 (636). 2 mths—1,362 (1,274).
Langkat Sumatra.—70 (85). 11 mths—809 (816).
Soember Ajoe.—12 (29). 2 mths—23 (54).
Sungei Bahru.—135 (105). 5 mths—655 (524).
Sungei Kahang.—172 (126). 9 mths—1,435 (1,278).
Tambira.—115 (110). 5 mths—573 (592).
Tamiang (Malaya).—78 (60). 2 mths—150 (132).
Tanjong Malim.—359 (364). 5 mths—1,921 (1,733).
Sennah.—66 (132). 11 mths—1,516 (1,478).

SHARPE, ESTALL AND CO. LTD.

November

Anglo-Johore Rubber Plantations Ltd.—28 (27). 4 mths—141 (129).
Bekoh CRE Ltd.—214 (192). 8 mths—1,618 (1,588).
KPRP Ltd.—46 (41). 8 mths—487, (397).
Rim (Malacca) RE Ltd.—243 (223). 5 mths—1,148 (1,105).
Sittang Valley RE Ltd.—176 (170). 5 mths—403 (476).
Kurunegala Rubber Co. (1929) Ltd.—32 (23). 11 mths—291 (304).

THOMAS BARLOW AND BROS.

November

Bradwall (FMS).—150. 11 mths—1,480 (1,577).
Chersonese (FMS).—71. 11 mths—696 (626).
Highlands and Lowlands.—2,053. 11 mths—20,956 (18,853).
Klabang.—121. 1 mths—1,055 (925).
Krian.—12. 11 mths—107 (159).
Muar River.—104. 11 mths—1,151 (1,361).
Sungei Krian.—155. 11 mths—1,716 (1,751).
Manchester N. Borneo.—77. 8 mths—581 (508).

November

Beau Sejour.—55 (42). 5 mths—279 (273).
Sungei-Timah.—47 (39). 8 mths—353 (376).

November

Kuala Reman.—129.

November

Kemasul.—42 (45). 11 mths—437 (462).
Inch Kenneth Kajang.—186 (153). 11 mths—1,849 (1,820).

Rubber Statistics

WESTERN GERMANY — JAPAN — THAILAND — FRANCE

DETAILS have now been issued by the Secretariat of the International Rubber Study Group of the West German rubber position up to the end of August last.

Imports of natural rubber during the first eight months of the year totalled 84,882 tons of crude and 8,808 tons of latex, or nearly 11,000 tons more than during the same period of 1958. Imports from Malaya increased by some 5,000 tons to 46,218 tons, while imports from Indonesia fell by nearly 8,000 tons to 13,883 tons. Rubber was also imported from Ceylon (8,249 tons), Thailand (3,080 tons), Nigeria (8,464 tons), the Belgian Congo (1,665 tons), British Borneo (862 tons), Burma (2,695 tons) and Vietnam (7,586 tons). After allowing for re-exports, there remained a new supply of 93,131 tons as compared with a new supply of 82,807 tons in the earlier period.

Consumption of natural rubber during these months amounted to 83,881 tons of crude and 8,398 tons of latex, and the total of 92,279 tons was some 5,000 tons above the 1958 figure for the same period. Stocks of natural at the end of August stood at 12,173 tons of crude and 1,312 tons of latex, having fallen by rather more than 1,400 tons during the course of the year.

Imports of synthetic totalled 21,720 tons, a reduction of some 6,000 tons compared with the previous year, and came from the USA (16,301 tons) and Canada (2,790 tons). Production on the other hand increased from 9,077 tons to 27,069 tons as a result of the opening up of new synthetic plants. Exports rose from 2,616 tons to 6,761 tons, leaving a new supply of 42,028 tons, an increase of more than 8,000 tons. Stocks of synthetic at the end of August had fallen to 5,860 tons, having stood at 7,224 tons at the beginning of the year.

Reclaim production during these months was slightly higher than in 1958 at 26,681 tons, and after allowing for exports there remained a new supply of 25,460 tons. Consumption amounted to 26,270 tons, an increase of nearly 3,000 tons, and stocks at the end of the period had fallen by some 800 tons since the beginning of the year to 4,087 tons.

Japan

The Study Group has also released details of the Japanese rubber position up to the end of July.

Imports of natural rubber amounted to 79,100 tons of crude and 7,844 tons of latex, giving a total of some 18,000 tons or about 25% above the previous year's figure. Malaya was the principal supplier with 67,394 tons as against 61,045 tons, and Indonesia sent 1,970 tons, Thailand 5,050 tons, Ceylon 5,887 tons and British Borneo 5,088 tons; imports from the two latter countries were approximately doubled, while Thailand sent only 10 tons of rubber to Japan during the earlier period.

Consumption of natural rubber during these months amounted to 82,080 tons of crude and 7,740 tons of latex, an increase compared with 1958 of over 20,000 tons or some 30%. Stocks of natural at the end of July stood at 10,959 tons of crude and 1,245 tons of latex, having fallen by about 3,000 tons during the course of the year.

Imports of synthetic rubber during this period increased two and a half times, from 8,853 tons to 20,799 tons. The USA was the main supplier with 18,225 tons, while Canada sent 2,066 tons. Consumption of synthetic went up from 9,150 tons to 16,180 tons, an increase of nearly 80%. Stocks of synthetic on hand at the end of July stood at 7,669 tons, having risen to this figure from 3,050 tons, at which they stood at the beginning of the year.

Thailand

It is announced from Bangkok that Thailand's rubber exports during October totalled 15,324 tons, an increase of 3,400 tons over the amount exported during September. It is reported that, of this total, 8,357 tons went to the USA, 1,153 tons to Japan, 2,308 tons to Singapore, 1,000 tons to Russia, 1,038 tons to the Federation of Malaya, 510 tons to Western Germany, and 221 tons to the UK.

France

According to the French Customs Board, France imported 1,907 tons of natural latex during October, 5,285 tons of smoked sheets, 331 tons of sole crepe, 3,418 tons of miscellaneous sheets and crepes, and 473 tons of other natural rubber grades, giving a total of 11,414 tons in all. The comparable figures for September were: Natural latex 1,819 tons, 5,133 tons of smoked sheets, 177 tons of sole crepe, 3,000 tons of miscellaneous sheets and crepes, and 328 tons of other grades, totalling 10,457 tons in all. South Vietnam supplied 3,152 tons of smoked sheets in October, and 1,312 tons of the miscellaneous sheets and crepes, while Malaya supplied 1,204 tons of the natural latex, 1,228 tons of the smoked sheets, and 1,662 tons of the miscellaneous sheets and crepes.

Synthetic rubber imports during October included 735 tons of butyl, 274 tons of polybutadiene styrene (in emulsion), 4,926 tons of other polybutadiene, 704 tons of polychlorobutadiene and 683 tons of other types, giving a total of 7,322 tons, as compared with the September figure of 5,879 tons.

W. J. GARNER TO RETIRE

As announced elsewhere in this issue Mr William John Garner, managing director of the P. B. Cow Group, is to retire on December 31. 'Bill' Garner, a familiar and popular figure in the industry, has been managing director of the group for ten years and chairman of the associated company, Sorbo, for twenty-five years. He is to relinquish these and other directorships in the group, including that of Elliot Equipment Ltd. He is also a director of several trust companies—positions he is carrying on—including Mombasa Investment Trust Co., Ropley Trust Ltd., and he is chairman and managing director of Timber Fireproofing Co. Ltd.

W. J. GARNER

Mr Garner, who lives at Croydon—and has lived there for most of his life — has taken a big part in the activities of the London section of the IRI Golfing Society, of which he is an ex-captain. Golf, in fact, is his chief hobby, and he is also chairman of his local club, the Croham Hurst Golf Club. He is fond of travel and has visited Australia to look over the company's interests there.

He is a member of the Honourable Company of Tinplate Workers, a Freeman of the City of London, and a member of the City Livery Club. He is a Freemason and holds London Grand Master rank and Provincial Grand Master rank. He is a Senior Past-Master of both his lodges.

During the last war he was active as a gunner in the Home Guard. After joining the Territorials in 1911 he served in World War I from the first day to the last.

He has two children, both of them married, and three grandchildren. One of his sons, Mr Peter J. Garner, is to become chief accountant of the P. B. Cow Group as from January 1.

He leaves for Capetown next month on a leisurely trip with Mrs Garner, and is to include a visit to Salisbury, Southern Rhodesia, to see a nephew.

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Incorporation of Starch in Porous Rubber

Nos. 816,853-4. The Hairlok Co. Ltd. Inventor: L. F. Everett. Application, December 21 1954. Filed, August 19 1955. Published, July 22 1959. No. 816,854 divided out of No. 816,853.

These two Specifications relate to the incorporation of starch into latex foam rubber thereby increasing the resistance of the foam rubber to compression to an appreciable extent even when the proportion of starch added is small.

According to the process of No. 816,853, an ungelatinized dispersion of starch in water is incorporated in the latex mix in a proportion of 1 to 8% of the weight of the solid ingredients. The mix is foamed and is then gelled without the application of sufficient heat to cause gelatinization of the starch. The gelled material is then heated to cause the starch grains to swell and burst, that is to gelatinize the starch. Heating may be, for example, for 20 minutes at 100°C. In an example, a latex foam rubber cushion without starch in the mix required a load of 9 kg. to produce 40% compression while with starch incorporated in the foam rubber by the process described, a load of 22.5 kg. was required to produce the same compression.

According to the process of No. 816,854, a previously formed resilient foam material having intercommunicating cells is treated with gelatinized starch in water so that the foam material is thoroughly wetted and impregnated with the starch solution, and the foam material is then dried. The foam material may be latex foam rubber or a plastic foam, while casein or an alginate may be used instead of starch. In an example, the same increase in the resistance to compression of a latex foam rubber cushion was achieved as in the example in No. 816,853, *i.e.*, from 9 kg. to 22.5 kg., by impregnating the latex foam rubber cushion with a 2% solution of gelatinized starch to effect a weight gain of 5%, after drying.

Shorter Abstracts

PVC Compositions. 817,041. Imperial Chemical Industries Ltd. Filed, September 11 1957.—Polyglycerols of average molecular weight between 300 and 7.500, or certain esters of such polyglycerols, are added to PVC to facilitate flow of the heat-softened plastic. The polyglycerol or ester thereof has two advantages; firstly it does not reduce the impact strength of the PVC at room temperature and secondly it reduces the tendency of the PVC to accumulate electrostatic charges.

Cross-linking of Polymers by Irradiation. 816,791. Centre National de la Recherche Scientifique. Filed, September 21 1955.—Cross-linking of synthetic resins and rubbers by irradiation is effected in the absence of oxygen to prevent oxidation of the material during the treatment.

Siliceous Pigments. 816,686. Columbia-Southern Chemical Corporation. Filed, January 14 1956.—A reinforcing pigment for use in rubber comprises a mixture of hydrated silica and an alkaline earth metal sulphite. The method of preparing the pigment is described in detail.

Rubber Markets

Owing to an early press date this week rubber market prices cannot usefully be reported. 'Rubber Markets' will appear as usual in our issue of January 2 1960.

COMPANIES in the NEWS

Pirelli

The board of the Societe Internationale Pirelli SA of Basle, proposes paying an unchanged dividend of 18 Swiss francs gross (12.6 francs net) per share from the net earnings of 5,987 million francs for the business year 1958/9. It also proposes increasing the capital to 48 million francs from 36 million francs by the issue at par of 80,000 new registered shares at the nominal value of 150 Swiss francs each. One new share for every three old shares held will be offered to shareholders during the current business year.

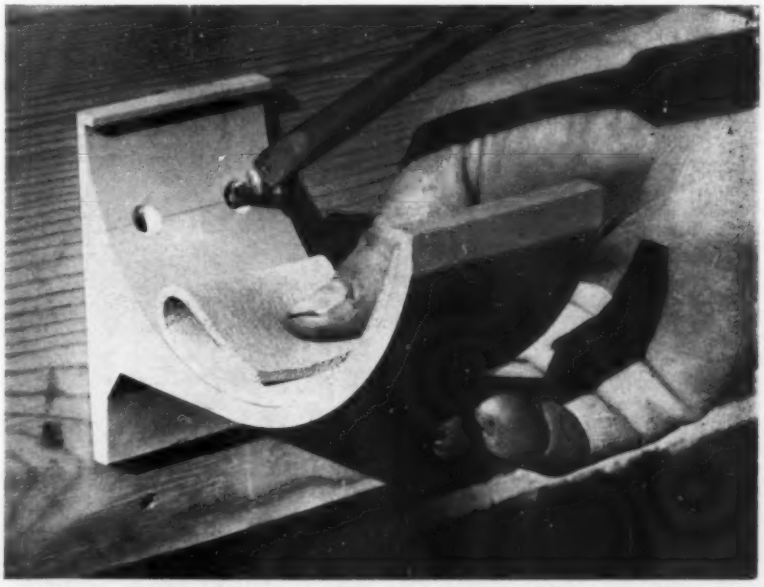
Reichhold Chemicals Ltd.

The Board of Reichhold Chemicals Ltd. are submitting to the ordinary shareholders proposals for increasing the authorized ordinary share capital to £1,000,000; they also propose capitalizing £78,234 out of undistributed profits by the free issue of one fully paid ordinary share of 5s. for every eight fully paid ordinary shares held.

The group profits for the first nine months of 1959 are again in excess of those of former years. The board are expected to recommend a final ordinary dividend of 12½% on the increased capital.

Rubber Toys Ltd.

Rubber Toys Ltd. are also winding-up voluntarily; the decision was taken at an extraordinary general meeting held at Croydon in November.



One of the most interesting features of the recent Building Exhibition at Olympia, London, was a display of plastics gutters and rainwater pipes by G. H. Osborn Building Products Ltd., Dollis Park, London, N.3 (reported in RJIP, December 19, 1959). Illustrated is a unit which shows the fixing method employed with 'OSMA' guttering. The gutter ends clip into the unit on top of a rubber seating and a firm and watertight seal is effected. The material used in the manufacture of the guttering is glass fibre and 'Cellobond' polyester resins by British Resin Products Ltd.

Industry INTELLIGENCE

Technical Data

Additive Paste 1600

Additive Paste 1600 is an activator for both organic and inorganic blowing agents while it facilitates dispersion of blowing agents and fillers. It is particularly suitable for use with nitrosamine blowing agents for which it serves also as a deodorant. Detailed information on the use of Additive Paste 1600 in rubber compounding is given in a booklet issued by the manufacturers, Rhein-Chemie, and available from the distributors, Lonabarc Ltd., 114 Cranbrook Road, Ilford, Essex.

Additive Paste 1600 is generally used in a proportion between 2 and 5% on the rubber content of the mix. In addition to activation of the blowing agent, the dispersing effect on the fillers of Additive Paste 1600 generally results in a shorter mixing cycle and a more plastic stock. Greater uniformity of the compound is achieved. The booklet contains a discussion of the production of microcellular soling, with special reference to the use of Additive Paste 1600, including typical mixes. The material is suitable also for use in direct vulcanization soling compounds and mixes are given for both microcellular and solid compounds of this type. Such compounds are often stored for long periods in the unvulcanized condition and an advantage of Additive Paste 1600 is that it strongly retards vulcanization at low temperatures, so that the compounds can be stored with safety. The booklet concludes with a discussion of the use of Additive Paste 1600 in cellular rubber made by the single stage and the double stage processes, with examples of mixes, and a note on the use of the material as a filler activator.

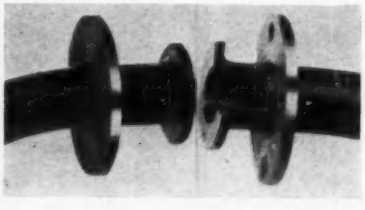
Butyl Rubber

Technical data sheets 7-12 concerning butyl rubber have been issued by the Esso Petroleum Co. Ltd. Technical Information Sheet No. 7—Yerzley Resilience—explains, with the aid of a diagram, three ways of computing percentage resilience. Technical Information Sheet No. 8—Identification of Butyl Rubber by Immersion in Tricresyl Phosphate—explains a quick identification test for butyl rubber, consisting of 70 hours immersion in TCP at 212°F. Only butyl and silicone rubbers have less than 10% under these conditions. Technical Information Sheet No. 9—Butyl to Metal Adhesion Systems—lists various butyl to metal adhesion systems, together with some adhesion values. Ty-Ply, Bostick, Chemlock and Thixon systems are among those mentioned. Technical Information Sheet No. 10—Processing Oils for Butyl Rubber—compares three process oils having low levels of straight chain unsaturation for efficiency as butyl plasticizers. Technical Information Sheet No. 11—Enjay Butyl Steam Hose—explains that the heat and moisture resistance of Enjay butyl make it an excellent polymer for use in steam hose. A compound is recommended for this application possessing good scorch safety and physical properties, and easy processing. Physical properties and costs are also included. Technical Information Sheet No. 12—Coumarone-Indene Resin as a Stiffening Agent for Enjay Butyl—states that a 10-part loading of coumarone-indene resin will cause a substantial increase in the Shore 'A' hardness of a butyl compound while maintaining its other physical characteristics. This hardness can be broken on flexing or heating, but will return once again after relaxing or cooling of the test sample. Coumarone-indene resin also serves as a processing aid for extrusion compounds imparting a high green strength and resistance to cold flow.

Machines, Materials and Equipment

New Flange for Polythene Pipe

Foster Brothers Ltd., Wednesbury, Staffs., claim that after some two years' experimental work, they have perfected a greatly improved process for flanging polythene pipe. Hitherto, joints on the larger sizes of polythene pipe



have been made by means of welded-on flanges or welded joints of the spigot and socket type. These processes involve the use of high temperatures which can cause deterioration of the material and embrittlement. Furthermore, there is no simple non-destructive test for polythene. The 'Bulldog' flange is the result of a patented process wherein the flange on the end of the pipe is formed out of a double thickness of the pipe wall. The heating medium employs hot gas or vapour under strictly controlled conditions so that the temperature of the material is only briefly raised to the region of its softening temperature. The backing flanges used to make the joint can be mild steel (black or galvanized), malleable iron, stainless steel or non-ferrous, and an ample radius is provided at the back of the 'Bulldog' flange to avoid stress concentration. The completed joint is wholly polythene-to-polythene (except for the joint ring used), and so corrosive fluids can be carried in safety as they cannot come into contact with any metallic surface. The 'Bulldog' flange is available in sizes 1in. to 6in. and is normally used in conjunction with 'Deltathene' high tensile pipe, although the process can be carried out on most materials in the plastics range, including 'soft' polythene and rigid PVC. Further information may be obtained from Foster Brothers Ltd., P.O. Box No. 20, Lea Brook Tube Works, Wednesbury, Staffs.

New Publications

BS for Rubber Hose (Fire Fighting)

The rubber reel hose specified in this new British Standard (BS 3169/1959) has a ¾in. (19mm.) internal diameter and is suitable for a working pressure of up to 150lb./sq. in. The hose meets the requirements of Home Office specification JCDD/7.

The 8 pp. publication (which replaces Ministry of Works specification MW/CS/136 gives requirements for materials, construction and dimensions. Physical tests on the finished hose are laid down, and detailed procedures for them are dealt with in a series of appendices. Copies of this standard may be obtained from the BSI, Sales Branch, 2 Park Street, London, W.1. Price 3s.

Acoustic Tiles

New office extensions of the British Recovered Rubber and Chemical Co. Ltd., at Clayton, Manchester, were recently fitted with 'Kilnoise' acoustic tiles. This tile is a new product of an all mineral cellular composition, which, the makers claim, gives dimensional stability under the severest humidity/temperature conditions. It is said to be non-combustible within the scope of section 1 BS 476:53.

BS for Ebonite-General Uses

Complementary to the British Standard for ebonite for electrical purposes (BS 234), this new publication (BS 3,164) specifies three types of material for supply in sheet, rod, tube, or moulding form. Dimensions and tolerances are laid down for the first three materials. Among other requirements in this six-page specification are those relating to plastics yield and cross-breaking strength, finish and machining. Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. Price 3s.

Export Opportunities

Plastics Bags for the US

Farnan and Seemann Inc., 752 North Highland Avenue, Hollywood, Los Angeles 38, California, have informed the British Consulate-General at Los Angeles that they would like to get in touch with UK manufacturers of plastics bags approximately 7in. x 10in. x 5in. with shoulder strap (not divided into compartments) to carry cameras and other photographic equipment. The plastics bags should be made to simulate leather, brown in colour, and it is requested that the plastics should be made with a natural resin as a binder rather than with a synthetic resin. They would import the bags on their own account and estimate that they could use about 100,000 a year.

Manufacturers interested in this enquiry should write direct to the US concern. It is important that quotations should show fob and cif prices in US currency. It would be appreciated if responding firms would copy their initial correspondence to the British Consulate-General, 448 South Hill Street, Los Angeles 13, California, to enable the enquiry to be pursued.

Guinea

The recent Anglo-Guinean Trade Agreement provides UK manufacturers and suppliers in many industries with considerable export opportunities. In future a growing amount of Anglo-Guinean trade, however, is likely to be channelled through the official Comptoir Guineen du Commerce Exterieur. The Director of the Comptoir has indicated to the British Embassy in Conakry that he would like to be supplied with the names of leading UK manufacturers. Categories of goods where, so far as can be judged at present, the United Kingdom is most likely to be well placed to sell to Guinea, include plastic materials, tyres and tubes, electric wires and cables, electric lamps and tubes, medical and surgical instruments and apparatus.

It is essential, states the Board of Trade, that in order to establish initial contact firms should be able to supply suitable trade literature in the French language.

Interested United Kingdom manufacturers should communicate in the first place with the Board of Trade Export Services Branch, Lacon House (Room 728), Theobalds Road, London, W.C.1, indicating the range of goods which they would be interested in selling to Guinea and enclosing their appropriate trade literature in French.

The address of the Export Services Branch of the Board of Trade is Lacon House, Theobalds Road, London, W.C.1. Telephone number: Chancery 4411, extensions 776 or 866.

Mr Stanley Griffiths has been elected a director of Plastic Engineers.

Future Events

INSTITUTION OF THE RUBBER INDUSTRY

Tuesday January 5 at the Institution, 4 Kensington Palace Gardens, London, W.8. Meeting of the Education Committee at 10.30 a.m. and of the Examinations and Qualifications Board at 12 noon.

North-Eastern Section. — Monday January 4 at the Eldon Grill, Grey Street, Newcastle, at 7 p.m. 'Siliceous Fillers,' by M. Pike, A.I.R.I. (Durham Raw Materials).

South Wales and Monmouthshire Section. — Monday January 4 at the Boot Hotel, Aberdare, at 7.30 p.m. 'Development and Uses of High Solids SBR Latex,' by J. Walker (Polymer (UK) Ltd.).

PLASTICS INSTITUTE

Friday January 1 at the Institution of Electrical Engineers, Savoy Place, London, W.C.2, at 2.30 p.m. Young People's Lecture.—'Sticky Plastics,' by N. A. de Bruyne (CIBA (ARL) Ltd.).

Plastics and Polymer Group, Society of Chemical Industry. — Tuesday January 5 at the SCI Meeting Room, 14 Belgrave Square, London, S.W.1. 'PVC Degradation and Action of Stabilizers,' by Dr E. C. A. Horner (I.C.I. Ltd.).

Boat Show

Trakmark, a canvas supported PVC sheeting specially designed for small craft, will be featured on the Dunlop stand at the Boat Show, Earls Court (December 30–January 9). It is said to provide a durable, non-slip, waterproof deck covering. Dunlop are also showing Duotarp, a PVC-coated nylon tarpaulin suitable for covering open cockpits and wheel houses, water lubricated rubber shaft bearings, Fortiflex rubber balers, flexible pipes for marine engines and rubber fenders.

Increases of Capital

KH Syndicate Ltd. (288,284) To acquire rubber estates in F.M. States, etc., 52 Leadenhall Street, E.C.3.—Increased by £17,000, in 1s. ordinary shares, beyond the registered capital of £43,500.

Dormac Ltd. (591,392) Manufacturers of plastic moulds and goods, etc., Waterloo Road, Lymington, Hants.—Increased by £10,400, in the £1 6% cumulative redeemable preference shares, beyond the registered capital of £100.

Elford Plastics Ltd. (535,322) Brookfield Works, Wood Street, Elland.—Increased by £1,000, in £1 ordinary shares, beyond the registered capital of £1,500.

Blythe Colour Works Ltd. (309,739) 1/4 Broad Street Place, E.C.2.—Increased by £100,000, in 4s. ordinary shares, beyond the registered capital of £525,000.

A. and N. Rubber Co. Ltd. (418,148), High Street, Frodsham, Ches.—Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Insulation Manufacturing Co. (Plastics) Ltd. (432,338), Imco Works, George Street, Glastonbury, Som.—Increased by £1,000, in 1s. employee shares, beyond the registered capital of £24,000.

East African Sisal Plantations Ltd. (233,384), Broad Street Avenue, E.C.2.—Increased by £210,000, in 420,000 unclassified 10s. shares, beyond the registered capital of £190,000.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

POLY-U (785,821) For all goods included in Class 17. By the Avon India Rubber Co. Ltd., "Avon" India Rubber Works, Melksham, Wiltshire. (Class 26; October 7 1959.)

CYLON (777,292) For articles of clothing and parts thereof included in Class 25, all being goods made of plastics. By the British Bata Shoe Co. Ltd., East Tilbury, Essex. (Class 25; November 11 1959.)

LUMINEX (782,675) For filaments and spun threads, all consisting of or coated with plastics in the form of film, for use in weaving into piece goods for textile purposes. By Dow Chemical Co. (UK), Ltd., 48 Charles Street, London, W.1. (Class 23; November 11 1959.)

MONAFOAM (791,255) For furniture, and parts thereof included in Class 20, all upholstered with foamed rubber or foamed plastics; and articles included in Class 20 made wholly or principally of foamed rubber or foamed plastics. By Irish Rubber Products Ltd., The Glen, Waterford, Republic of Ireland. Address for service is c/o Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2. (Class 20; November 11 1959.)

SUNSHINE (782,479) For vacuum flasks and vacuum jugs; and drinking cups made of plastics and being fittings for vacuum flasks. By the British Vacuum Flask Co. Ltd., 31-32 Alfred Place, London, W.C.1. (Class 21; November 11 1959.)

NIGHTLINER (792,740) For cushions (upholstery), mattresses, pillows (not for surgical or curative purposes) and upholstered parts of furniture. By the Dunlop Rubber Co. Ltd., Fort Dunlop, Erdington, Birmingham, 24. (Class 20; November 11 1959.)

NESPAK (788,676) For containers (in the nature of trays) made wholly or principally of plastics for the storage of fruit or eggs. By Guido Martelli, Nerio Martelli and Francesco Martelli, Piazza XX, Settembre 5, Bologna, Italy. Address for service is c/o Page White and Farrer, 27 Chancery Lane, London, W.C.2.

SCOPRACRON (791,621). For synthetic resins and synthetic resin compositions included in Class 1, all for use in manufactures. By Styrene Co-Polymers Ltd., 1 Roebuck Lane, Sale, Cheshire. To be associated with No. 682,244 (3748. 105) and others. (Class 1; November 11 1959.)

PERSPEX acrylic sheet

(791,398) For parts included in Class 12 of aircraft, watercraft or of land vehicles, all being goods made principally of acrylic sheet. By Imperial Chemical Industries Ltd., Imperial Chemical House, Millbank, London, S.W.1. To be associated with Nos. 507,722 (2720, 748) and 645,900 (3605, 278) and others. (Class 11; November 11 1959.)

COLORFON (789,636) For shaped covers of plastics for fitting over telephones. By Alldan Products Ltd., 41 George Street, Baker Street, London, W.1. (Class 9, November 25 1959.)

Latest Wills

Mr Robert Paul Marchant, of 26 Bentinck Close, Prince Albert Road, N.W.8, formerly of Hendon Lane, Finchley, rubber merchant, who died on September 16 last, left £28,977 gross, £28,067 net value. (Duty paid £6,704.)

Mr Reginald Frederick Holden, of 35 Sion Court, Twickenham, managing director of the Poppe Rubber and Tyre Co. Ltd., Twickenham, who died on September 18 last, left £3,651 gross, £3,345 net value. (Duty paid £33.)

NEW COMPANIES

Simpson's Tyres Ltd. (641,455). — November 6. Capital: £1,500 in £1 shares. To carry on the business of manufacturers of and dealers in tyres, etc. The directors are: Ida Simpson and Patricia Simpson, both of 110 Woodthorne Road South, Tettenhall; Graham Thomson, 98 Mill Lane, Wednesfield. Regd. office: Five Ways Garage, Lower Stafford Street, Wolverhampton.

A. J. Thomson and Co. Ltd. (641,558).— November 10. Capital: £10,000 in £1 shares. To carry on the business of manufacturers, merchants, factors, dealers, importers and exporters of leathers, hides, india rubber, gutta percha, etc. The first directors are to be appointed by the subscribers. Solicitors: Slaughter and May, 18 Austin Friars, E.C.2.

Woodley's Tyre Services Ltd. (643,401).— December 1. Capital: £100 in £1 shares. The directors are: Arthur P. Woodley, Kenneth Woodley, Gordon Woodley, all of 85 The Greenway, Uxbridge, Middlesesx. Regd. office: Rear of 81 Oxford Road, Denham, Uxbridge, Middlesex.

Rainmak Plastics Ltd. (639,921).—October 19. Capital: £5,000 in £1 shares. To carry on the business of manufacturers of and dealers in water and rainproof coats, aprons, collars, cuffs, canvas clothing, etc. The directors are: Myer Marcus, 1 Chalgrove Gardens, Finchley, N.3; Mrs Lilian H. Marcus, 1 Chalgrove Gardens, Finchley, N.3; Michael J. Marcus, 1 Chalgrove Gardens, Finchley, N.3. Regd. office: St. Andrew's House, 32 Holborn Viaduct, London, E.C.1.

Micro and Precision Mouldings (Cheltenham) Ltd. (639,799).—October 16. Capital: £2,000 in £1 shares. To carry on the business of manufacturing, dealing, trading, and supplying, plastic and metal components and units, etc. The directors are not named.

Acrow (Reinforced Plastics), Ltd. (639,877).—October 19. Capital: £10,000 in £1 shares. The directors are: William A. de Vigier, 'Tinkers Lodge,' Marsh Lane, Mill Hill, N.W.7; Ronald W. Gourdie, 'Methven,' Main Drive, Iver, Bucks; Colin Ballard, Birling Cottage, East Dean, near Eastbourne. Regd. office: South Wharf, London, W.2.

Lorenzo Quiligotti Ltd. (641,347). — November 5. Capital: £100 in £1 shares. To carry on the business of flooring manufacturers, contractors and specialists, etc. The directors are: Archibald J. Preston, 227 Bramhall Lane South, Bramhall, Ches.; Lorenzo Quiligotti, 69 Blackwin Street, Manchester, 12. Regd. office: 2 Mosley Street, Manchester, 1.

Tyre Service Holdings Ltd. (642,829).— November 24. Capital: £25,000 in £1 shares. To carry on the business of manufacturers of and dealers in rubber and rubber substitute tyres, etc. The subscribers (each with one share) are: Leonard J. Paice, 28 Kingsmead Avenue, Worcester Park, Surrey; Cyril D. Way, 93 Claremont Road, Highgate, N.6. The first directors are to be appointed by the subscribers. Solicitors: J. H. Lambert and Co., 310/312 Regent Street, London, W.1.

PATENT LIST

Printed copies of the Specifications in the following list, published by permission of the Controller of H.M. Stationery Office, can be obtained from the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d., including postage, but about six weeks after the date of this publication will usually elapse before they come available. Orders with remittance may be sent in advance to the Patent Office, and will be fulfilled immediately the Specifications are published.

COMPLETE SPECIFICATIONS ACCEPTED

Open to public inspection on September 30 1959

Styrene Products Ltd. Mouldable thermoplastic material. 820,906.

California Research Corporation. Polyester plasticizers for aminoplast resins. 821,176.

Onderzoekingsinstituut Research N.V. Method and a device for crimping thermoplastic threads in a stuffer box. 821,179.

Bergwerksgesellschaft Hibernia A.G. Method of producing propylene polymers. 821,118.

Boehme Fettchemie G.m.b.H. Process for the preparation of polyalkylene-polyamine condensation products suitable as textile assistants. 821,082.

Devoe and Raynolds Co. Inc. Epoxide resins. 820,991.

Devoe and Raynolds Co. Inc. Modified epoxide resins. 820,992.

Devoe and Raynolds Co. Inc. Epoxide resins. 820,993.

Onderzoekingsinstituut Research N.V. Preparation of polyamide moulding materials. 820,994.

Canadian Industries Ltd. Block and graft copolymerization. 821,000.

Triple-Seal Corporation. Device and method for sealing punctures in tubeless tyres. 821,183.

Badische Anilin- and Soda-Fabrik A.G. Production of polymers. 821,186.

National-Standard Co. Method of manufacturing tyres. 820,825.

Continental Gummi-Werke A.G. Process for the manufacture of articles from dispersions of polymers of halogenated ethylene. 820,827.

O. W. Burke. Polymeric materials. 820,930.

COUNTY COURT JUDGMENTS

NOTE.—*These Judgments which are supplied from the Registry of County Court Judgments, Lord Chancellor's Department, 3 Dean's Yard, London, S.W.1, are not necessarily for debt, and some may have since been satisfied. They may be for damages or otherwise, they may relate to actions bona fide contested between the parties, or they may be against defendants liable in a representative capacity and not personally; but no distinction is made on the register. A judgment does not imply inability to pay. Judgments are not returned to the Registry if satisfied in Court Books within twenty-one days.*

INORGANIC PLASTICS LTD., Hayes Road, Sully, Glamorgan. Barry, £14 3s. 11d., May 1 1959.

LAWRENCE JOHN TYZACK, 2 Grove Street, Edmonton, N.18, Middlesex, rubber merchant. Edmonton, £19 7s., April 13 1959.

RUBBER ASBESTOS AND FLOORINGS LTD., Pitfall Street, Call Lane, Leeds 2, Yorks. Westminster, £28 12s. 9d., May 12 1959.

PLASTICS AND ERINOID WARES LTD., Seymouth House, Albert Street, Birmingham. Birmingham, £22 0s. 3d., May 20 1959.

ALPHA PLASTICS AND ENGINEERING CO. LTD., 61 Southwood Drive, Tolworth, Surrey. Westminster, £33 17s., May 26 1959.

K. ROWLES AND R. H. DYKEHOUSE (T/A THE DYKEHOUSE INTERNATIONAL CO., LUXEMBOURG), 116 Dawley Road, Hayes, Middlesex. Westminster, £189 14s., June 10 1959.

INORGANIC PLASTICS LTD., Hayes Farm, Hayes Road, Sully, Penarth, Glamorganshire. Hanley and Stoke-upon-Trent, £11 15s., June 10 1959.

PLASTIC DEVELOPMENTS, 113 Derby Road, Southampton, Hants. Westminster, £11 8s. 3d., August 19 1959.

ALEC BOYD, Carlton House, Mansfield Road, Chesterfield, Derby, tyre distributor. Birmingham, £25 5s. 2d., July 7 1959.

SENIOR WEAVER, 332 Lodge Road, Hockley, Birmingham, scrap tyre dealer. Birmingham, £43 13s. 6d., August 6 1959.

STRUCTURAL PLASTICS (SP) LTD., Eythorne, Dover, Kent, laminate manufacturers. Canterbury, £50 1s. 8d., August 7 1959.

JOSEPH O'DRISCOLL, 28 Shadwell Drive, Northolt, Middlesex, tyre dealer. Manchester, £61 11s., July 31 1959.

JUSTRITE PLASTIC PRODUCTS LTD., 36 Upper Thomas Street, Merthyr Tydfil, Glamorgan. Merthyr Tydfil, £109 10s. 8d., September 8 1959.

LEEDS TYRE SALVAGE, 15 Bowman Lane, Leeds 10, Yorkshire. Leeds, £15 7s. 3d., September 2 1959.

Rubber Journal and International Plastics CLASSIFIED ADVERTISEMENTS

APPOINTMENTS VACANT

A FURTHER vacancy occurs in rapidly expanding laboratory North Manchester area. Applicants with experience in latex technology please write stating full particulars, age, salary required to:—Box 376. (376)

AUSTRALIAN rubber company located in Victoria requires two young men with experience for mill/forcing chargehand and moulding chargehand. Commencing wage A£23 per week. Both positions represent an opportunity for intending emigrants to join a small progressive Australian company. Successful applicants would spend some time with an associated company in England before leaving for Australia.—Full details in confidence to Box 379. (379)

RUBBER manufacturers in Manchester require a rubber technologist aged 35-45 for factory process control work. The post calls for a man having a flair for organization. Experience in the manufacture of belting, hose and mechanicals would be an advantage. Apply in own handwriting giving full details of past experience, age and salary required.—Box 378. (378)

APPOINTMENTS VACANT

ASSISTANT rubber technologist. L.I.R.I. production experience of footwear compounds. Excellent prospects.—Sam Kay Rubber Co. Ltd., Hope Mill, Portwood Place, Stockport, Cheshire. (369)

TECHNICAL assistant required by medium-size rubber company located near London. The company is expanding and there is considerable scope for a young man with reasonable engineering background. State age, experience, qualifications and salary required, in confidence, to Personnel Manager.—Box 375. (375)

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WANTED. Second-hand tyre splitting machine in first-class mechanical condition, suitable for production of pulled cord patches for an export order. Please write giving fullest details and lowest cash price.—Grantham Rubber Machinery Co. Ltd., Grantham. (377)

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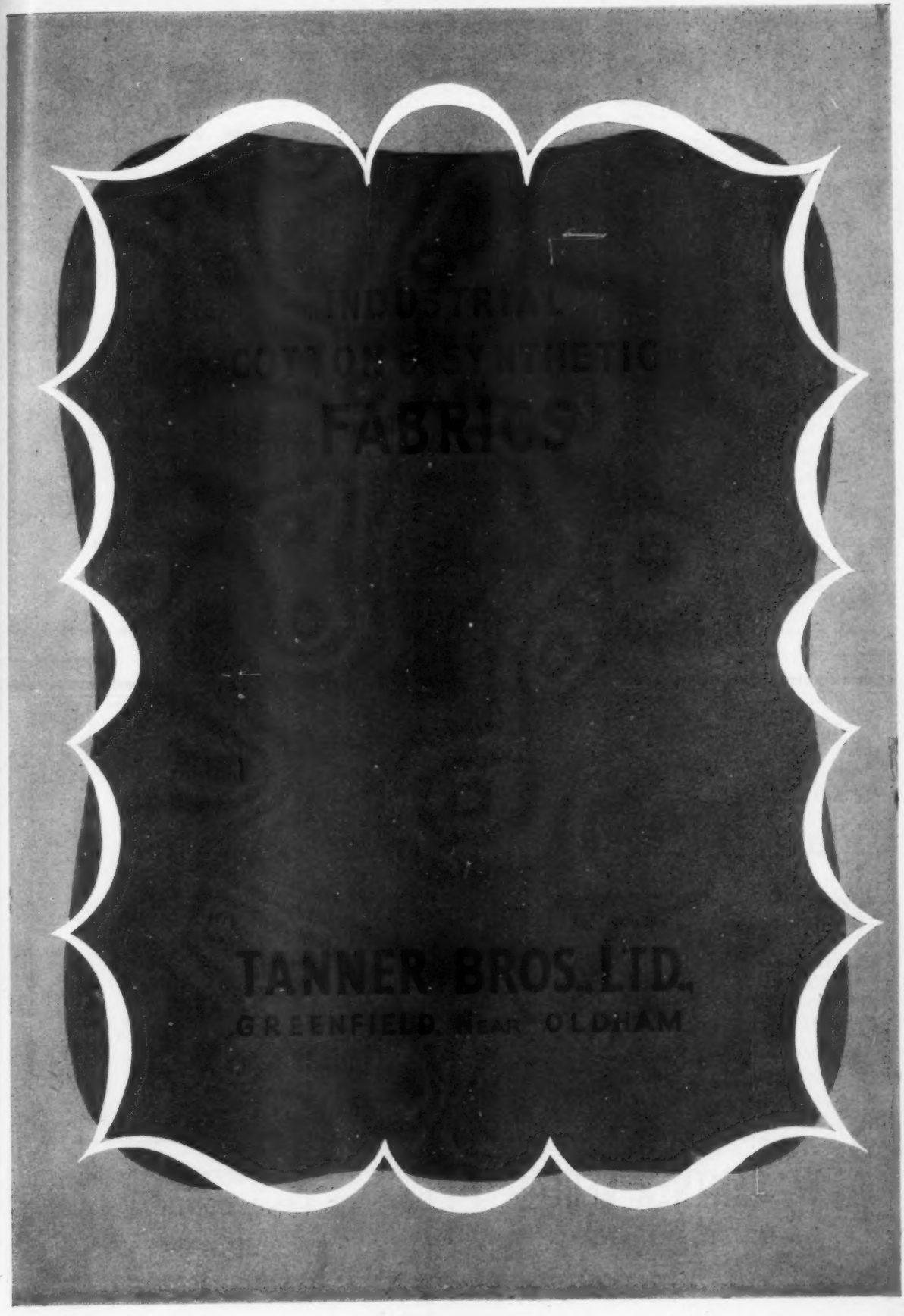
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OAKES continuous automatic mixer, class No. 68/24. 1-3,900 gallons, and 1-1,500 gallons, steel storage tanks, unlined.—Box 371. (371)

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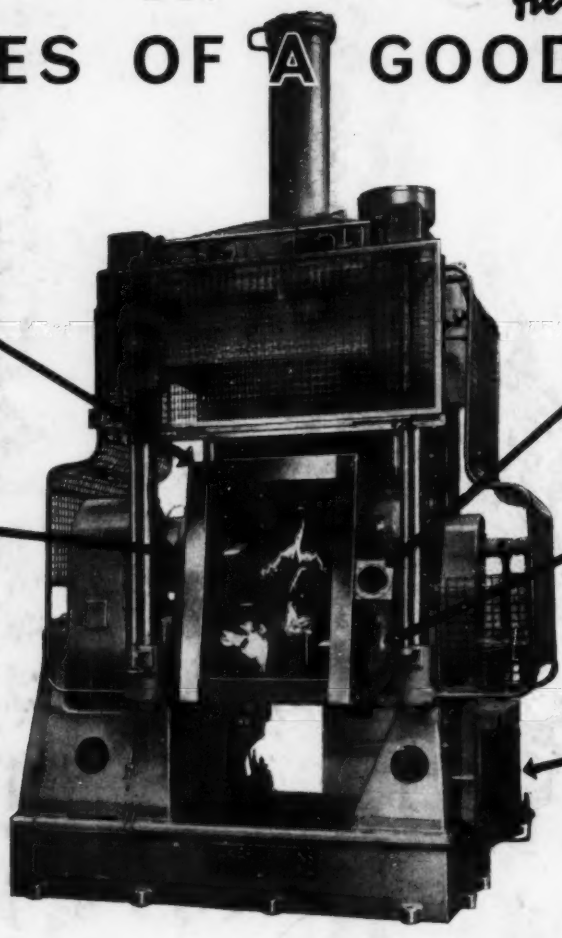

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